FISHERY MANAGEMENT INVESTIGATIONS

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FISHERY MANAGEMENT ANNUAL REPORT

Ed Schriever, Director

SOUTHWEST REGION - MCCALL
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ABSTRACT

Six mountain lakes located in the McCall Sub-region (Little Salmon River and South Fork Salmon River drainages) and the Salmon Region (Middle Fork Salmon River drainage) were surveyed between July 23 and August 9, 2018. According to IDFG records, none of the six lakes had ever been surveyed before. Of the six lakes surveyed during the 2018 field season, only two contained fish. At Shepherd Lake, we captured 18 Westslope Cutthroat Trout *Oncorhynchus clarkii* during 13.3 hours of gill-netting (1.4 fish/h) and five Westslope Cutthroat Trout during one hour of angling (5.0 fish/h). Westslope Cutthroat Trout captured at Shepherd Lake (n = 23 total) ranged in total length from 105 to 325 mm, and averaged 192.8 mm. No weights were obtained from fish captured at Shepherd Lake. At Nick Creek Lake #2, we captured four Rainbow Trout *Oncorhynchus mykiss* during 15.0 hours of gill netting (0.3 fish/h) and two Rainbow Trout during one hour of angling (2.0 fish/h). Rainbow Trout captured at Nick Creek Lake #2 (n = 6 total) ranged in total length from 350 to 380 mm, and averaged 366 mm. The mean relative weights of gill netted fish (n = 4) was 84 (range = 83 to 86). No fish were collected or observed in the remaining four lakes surveyed. Amphibians were observed at 100% (n = 2) of lakes that contained fish, and 75% (n = 3) of lakes that were fishless.

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INTRODUCTION

In Idaho, high mountain lake anglers have consistently expressed high satisfaction with their experience (IDFG 2018). High mountain lakes offer diverse angling opportunities in highly scenic areas and are an important contributor to the state's recreational economy.

Surveys are conducted periodically in high mountain lakes (HMLs) throughout the state to evaluate the current status of each fishery. The data collected from these surveys provides information on lake productivity, fish species composition and relative abundance, fish size and body condition, relative amount of human use, and amphibian species occurrence. This survey information guides our HML management program, and helps identify the best use of stocking resources.

OBJECTIVES

1. Collect fish presence, species composition, relative abundance, and size structure information from HMLs each year to help guide management direction for these fisheries.

STUDY SITES

Artillery Dome Lake is a very remote lake located at 44.674°N, -115.204°W, west of the Middle Fork Salmon River, in the Frank Church – River of No Return Wilderness. Topographical maps (USGS 24k) indicate there is a 9.5-km long trail to Artillery Dome Lake, originating at the Lucky Lad Mine to the west. However, the lake likely sees most of its limited use by way of a user trail originating at Pistol Creek Ranch on the Middle Fork Salmon River. Artillery Dome Lake is currently stocked once every three years with 1,000 fingerling Westslope Cutthroat Trout *Oncorhynchus clarki lewisi*. The lake was last stocked in 2016. No previous survey records exist.

George and Rob's Lake (Unnamed in IDFG hydro-layer) is located at 44.496 °N, -115.647°W, at the headwaters of Bull Creek in the Middle Fork Payette River drainage. From Deadwood Reservoir, on the Deadwood River, there is an 8.4-km long pack trail leading to a saddle just above the lake. The trail is very steep, climbing 610 m over 4 km. This lake was stocked once, in 1995, with 450 fingerling Rainbow Trout *Oncorhynchus mykiss*. No previous survey records exist.

Shepherd Lake is located at 45.105 °N, -116.209°W, on the north side of Granite Mountain, northwest of McCall. From the Twin Lakes trailhead, it is approximately a 4.8-km hike to Shepherd Lake, requiring steep cross-country navigation. Fire lookout personnel stationed at Granite Mountain Fire Lookout have commented that angler use is likely very low at Shepherd Lake (based on little to no observations of hikers in the basin). We currently stock 500 fingerling triploid Rainbow Trout once every three years in Shepherd Lake, although the last year the lake was stocked was 2014. No previous survey records exist.

Nick Creek Lake #2 is located at 44.929 °N, -115.866°W, south of Nick Peak, east of McCall. Anglers typically access Nick Lake (Nick Creek Lake #2) via the Buckhorn Trailhead on the South Fork of the Salmon River. From there, it is approximately a 10.5-km hike (mixture of trailed and cross-country) to access Nick Lake. Nick Creek Lake #2 is stocked once every three years with 500 triploid Rainbow Trout. Nick Creek Lake #2 was last stocked in 2018. No previous survey records exist.

Lunch Creek Lake is located at 44.652 °N, -115.583°W, approximately 1.5 km north of Warm Lake Summit/Summit Lake trailhead. Lunch Creek Lake was stocked with 700 Rainbow Trout in 1990, and has not been stocked since. No previous survey records exist.

Grenade Lake is located at 44.676 °N, -115.241°W, in the same vicinity of the previously mentioned Artillery Dome Lake (Artillery Lake is also in this area, but was not surveyed in 2018). Like Artillery Dome Lake, Grenade Lake is very remote. Grenade Lake was stocked with 1,160 fingerling Cutthroat Trout (likely Westslope Cutthroat Trout) in 1967, and 1,624 fingerling Rainbow Trout in 1971, but has not been stocked since. No previous survey records exist.

METHODS

We sampled the fish community at four lakes using Swedish-style mountain lake gill nets, fished overnight. Artillery Dome Lake was surveyed using one sinking and one floating net, George & Rob's Lake and Shepherd Lake were each surveyed with one floating net, and Nick Creek Lake #2 was surveyed using one sinking net. Swedish-style monofilament gill nets were 36-m long by 1.8-m deep, and composed of six panels of 10.0-, 12.5-, 18.5-, 25.0-, 33.0-, and 38.0-mm mesh. Lunch Creek Lake and Grenade Lake were not gill-netted, but were only visually inspected for fish due to their shallow depth and lack of fish activity. Captured fish were enumerated, measured to the nearest mm total length (TL) and weighed in grams (g). We built length-frequency histograms and calculated mean TL for each species at each lake to describe size structure. Relative weights (W_r) were calculated for fish larger than 130 mm TL using the standard weight (W_s) equation:

$$Log_{10}(W_s) = a + b * Log_{10}(\text{total length (mm)})$$

where *a* = the intercept value and *b* = slope derived from Blackwell et al. (2000; Appendix A). The log value is then converted back to base 10, and relative weight is then calculated using the equation:

$$W_r = \left(\frac{\text{weight (g)}}{W_s}\right) * 100$$

At each lake, we assessed presence and relative abundance of amphibians using a modification of the timed visual encounter survey (VES; Crump and Scott 1994). The main deviation from the VES methodology was that the survey crew performed a full-perimeter search without accounting for various habitat types. Survey data were entered into the IDFG 'Lakes and Reservoirs' database.

RESULTS AND DISCUSSION

Of the six lakes surveyed during the 2018 field season, only two contained fish. We captured 18 Westslope Cutthroat Trout during 13.3 hours of gill-netting (CPUE = 1.4 fish/h) and five Westslope Cutthroat Trout during one hour of angling (5.0 fish/h) at Shepherd Lake. Westslope Cutthroat Trout captured at Shepherd Lake (*n* = 23 total) ranged in length from 105 to 325 mm, and averaged 193 mm (Table 1, Figure 1). No weights were obtained from fish captured at Shepherd Lake. At Nick Creek Lake #2, we captured four Rainbow Trout during 15.0 hours of gill-netting (0.3 fish/h) and two Rainbow Trout during one hour of angling (2.0 fish/h). Rainbow Trout captured at Nick Creek Lake #2 (n = 6) ranged in total length from 350 to 380 mm, and averaged 366 mm (Table 1, Figure 1), and relative weights of gill netted fish (n = 4) averaged 84 (range = 83 to 86). No fish were collected or observed in the remaining four lakes surveyed, which was not surprising given that they were all relatively shallow, have not been recently stocked, and generally appeared to lack suitable habitat to support fish persistence over winter.

Amphibians were observed at both lakes (n = 2) that contained fish, and 75% (n = 3) of lakes that were fishless (Table 2). Shepherd Lake contained Columbia Spotted Frog (*Rana luteiventris*), George & Rob's Lake held both Columbia Spotted Frog and Western Toad (*Anaxyrus boreas*), and Nick Creek Lake #2 held Western Toad. Long Toed Salamanders (*Ambystoma macrodactylum*) was observed at both Grenade and Artillery Dome lakes. No amphibians were observed in or around Lunch Creek Lake.

MANAGEMENT RECOMMENDATIONS

1) Discontinue stocking Rainbow Trout in Shepherd Lake. The fishery is maintained by naturally-reproducing Westslope Cutthroat Trout.

2) Continue stocking triploid Rainbow Trout in Nick Creek Lake #2.

3) Continue surveying high mountain lakes in the McCall subregion to determine whether stocking changes are needed.

Table 1. Total number of fish collected by species and lake (catch) using IDFG standard high mountain lakes gill nets and angling surveys between July 23, 2018 and August 9, 2018.

		Angling			Gill-netting			TL (mm)		W_r	
Lake name	Species	# caught	Effort (hrs)	CPUE (fish/h)	Catch	Effort (hrs)	CPUE (fish/h)	Mean	Range	Mean	Range
Shepherd Lake	Westslope Cutthroat Trout	5	1.0	5.0	18	13.3	1.4	192.8	105 - 325	--	--
Nick Creek Lake #2	Rainbow Trout	2	1.0	2.0	4	15.0	0.3	365.8	350 - 380	84	83 - 86

Table 2. Mountain lakes sampled in 2018 including catalog number, primary fish species present, (most abundant listed first), amphibian presence, stocking history, and level of human use surveyed between July 23, 2018 and August 8, 2018.

Lake	Catalog number	Fish species observed	Year last stocked	Species	Amphibians Present	Human Use
Shepherd Lake	07-0174	[1]WCT	2014	[2]RBT	Columbia Spotted Frog	Rare
Lunch Creek Lake	07-0460	None	1990	[2]RBT	None	Low
Nick Cr. Lake #2	07-0478	[2]RBT	2018	[2]RBT	Western Toad	Rare
George & Rob's Lake	07-0526	None	1995	[2]RBT	Western Toad, Columbia Spotted Frog	Rare
Grenade Lake	07-0970	None	1971	[2]RBT	Long Toed Salamander	Rare
Artillery Dome Lake	07-0973	None	2016	[1]WCT	Long Toed Salamander	Rare

[1]WCT=Westslope Cutthroat Trout, [2]RBT=Rainbow Trout

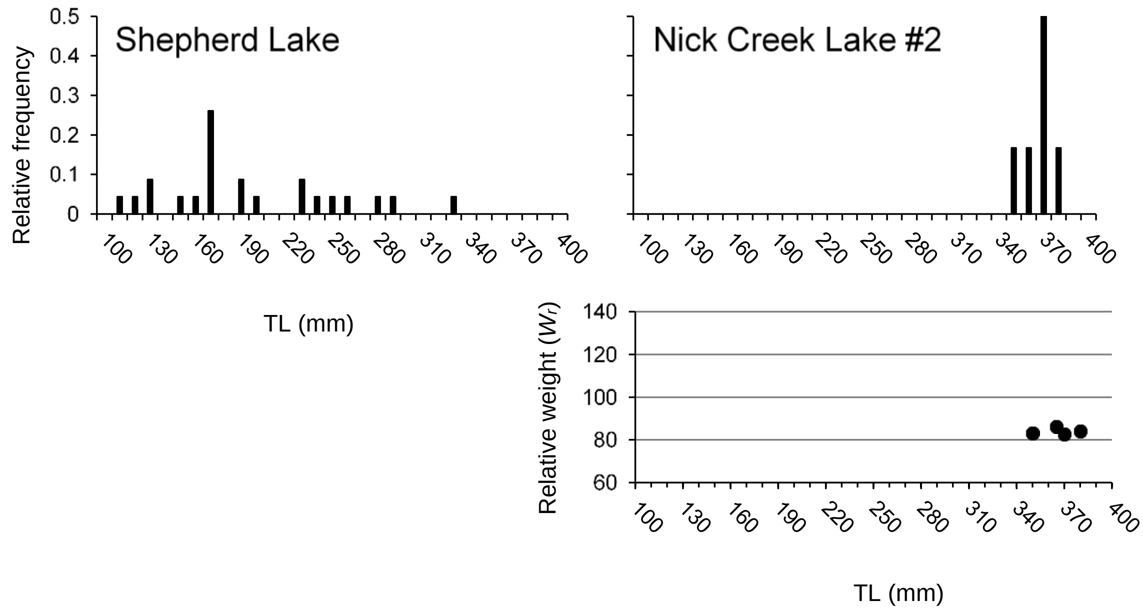

Figure 1. Relative length-frequency histograms for Westslope Cutthroat Trout captured in Shepherd Lake (n = 23) and Rainbow Trout captured in Nick Creek Lake #2 (n = 6) in 2018, along with relative weights for fish in Nick Creek Lake #2.

LOWLAND LAKES

LAKE CASCADE FALL GILL-NETTING SURVEY

ABSTRACT

Annual gill-netting surveys are conducted in Lake Cascade each October to monitor changes in abundance and size structure of the fish community. Previous work at Lake Cascade suggests that an increase in the abundance of large (>350 mm) Northern Pikeminnow *Ptychocheilus oregonensis* can have significant negative impacts on the Yellow Perch *Perca flavescens* and Rainbow Trout *Oncorhynchus mykiss* fishery. Therefore, these surveys help managers determine if and when management intervention (i.e. rotenone application) is needed to reduce NPM abundance to improve fishery quality. In 2018, 1,055 fish of 11 species were captured. Yellow Perch composed 16.4% of the total catch (n = 183), Rainbow Trout composed 15.6% of the catch (n = 165), and Smallmouth Bass *Micropterus dolomieu* composed 6.1% (n = 59). Largescale Sucker *Catastomus macrocheilus,* Northern Pikeminnow (NPM), and Black Bullhead *Ameirus melas* composed 23.2% (n = 244), 22.0% (n = 239), and 10.8% (n = 118) of the catch, respectively. Abundance and size structure of Yellow Perch and Northern Pikeminnow in 2018 were similar to 2017 results. Mean number of fish caught per pair of gill nets in 2018 (catch per site; ± 90% CI) for Yellow Perch was 12 (± 3), with an average of 7 (± 3) greater than 250 mm, and mean catch per site for all NPM was 16 (± 6), with an average of 4 (± 2) greater than 350 mm. These results suggest no immediate management intervention is needed to reduce Northern Pikeminnow abundance in Lake Cascade.

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INTRODUCTION

Lake Cascade has a long history of fishery management activities dating back to 1958; only ten years after the dam was erected and the reservoir was formed. Since the early years of the fishery, biologists have found that the quality of the sport fishery in Lake Cascade (primarily Yellow Perch *Perca flavescens*, and to a lesser extent Rainbow Trout *Oncorhynchus mykiss,* kokanee *Oncorhynchus nerka*, and bass (*Micropterus spp.*) is negatively affected by Northern Pikeminnow *Ptychocheilus oregonensis* (NPM) abundance, due to predation by NPM on young sport fish. Chemical treatments of NPM spawning tributaries in 1958-1962 and 1968-1974 removed a total of 825,000 and 428,500 NPM, respectively (Bennett, 2004). Subsequently, the quality of the sport fishery (trout and perch) increased substantially. Angler effort reportedly increased from approximately 129,000 hours in 1972, to 400,000 hours by 1980, with perch composing more than 70% of angler harvest.

Throughout the 1980s and early 1990s, the sport fishery at Lake Cascade was extremely popular. Despite a sharp decline in perch abundance in the mid-1990s, Lake Cascade was ranked ninth in Idaho for angler hours and fish landed (IDEQ 1996). However, due to low recruitment of perch in the lake beginning around 1990, the perch fishery collapsed by the early 2000s. This collapse in the early 2000s resulted in a sharp decline in angler effort, and a loss of approximately $6 million in terms of the overall economic value of the fishery (Bennett, 2004). Again, this collapse was found to be caused by high predation rates by NPM. Biologists found that a NPM population dominated by fish greater than 350 mm and a marked decline or absence of juvenile perch often predicted a pending decline in the quality of the perch fishery (Allen et al. 2009).

From 2004 to 2006, biologists implemented another large-scale restoration effort at Lake Cascade, which included removing nearly 30,000 NPM and stocking over 860,000 perch transplanted from Phillips Reservoir near Sumpter, OR and Lost Valley Reservoir near Pineridge, ID (Janssen et al. 2008). The quality of the sport fishery again improved; and by 2011, IDFG estimated the economic value of the fishery increased to $11 million (IDFG - 2011 Economic Survey). Since 2014, Lake Cascade has produced three state record perch, and two world record perch.

Since perch restoration efforts were completed, fisheries management objectives in Lake Cascade have primarily been focused on monitoring changes in perch and NPM abundance and size structure, in order to determine when further NPM suppression efforts will be necessary. Objectives listed in the IDFG 2019-2024 Fisheries Management Plan (IDFG 2018) specify that adult NPM abundance should be aggressively reduced if mean catch per site of NPM greater than 350 mm reaches or exceeds 10, or percent of NPM greater than 350 mm reaches or exceeds 75% of all NPM caught during fall gill-netting.

Gill-netting surveys are conducted every October in Lake Cascade to monitor changes in abundance and size structure of the fish community. Since 2012, these surveys have been standardized to occur on or near the same dates, at the same sites, with the same amount of effort and gear type.

OBJECTIVES

1. Monitor relative abundance and size structure of the NPM community in order to determine whether suppression efforts are needed in the near future to reduce predation on perch.

2. Monitor sport fish relative abundance, size structure, and condition to assess current fishery quality.

METHODS

We sampled 15 gill net sites from October 1 through 5, 2018. These sites are described in Janssen et al. (2014). Each site was sampled once, each with one pair (one floating and one sinking) of IDFG standard experimental gill nets (each 46-m long x 2-m deep, with six panels consisting of 19-, 25-, 32-, 38-, 51-, and 64-mm bar mesh). At shoreline sites, sinking gill nets were attached to shore, unless in very shallow, low slope bottom areas, where nets were set in at least one meter of water. Also at shoreline sites, the floating net was set in a minimum of three meters deep water, as close to the shoreline set as possible. Nets were fished overnight and pulled the next day, and catch per unit effort (CPUE = mean number of fish per pair of gill nets at a site; ± 90% confidence intervals) was calculated to compare relative abundance with previous years. Significant differences in catch rates between years are determined to be those which 90% confidence intervals do not overlap.

All fish were identified and measured for total length (nearest mm) and a subsample of five (5) of each 10-mm length group were weighed. Length-frequency histograms were built for each species to show size structure of fish sampled, and we calculated proportional stock density (PSD-Q) and incremental relative stock densities (RSD) for perch (130 mm stock length and 200 mm quality length) and Smallmouth Bass *Micropterus dolomieu* (180 mm stock length and 300 mm quality length) to compare size structure with previous years. We also used length and weight data to calculate mean relative weights (W_r) for each species, except hatchery Rainbow Trout where condition factor was calculated to determine body condition and compare with previous years.

Ages were applied to length frequencies to develop catch curves. These catch curves were used to determine relative survival rates between age/length classes among years.

RESULTS

During standard fall gill-netting in October, 2018, we caught 1,055 fish of 11 species in Lake Cascade (Table 3). Perch composed 16.4% of the total catch (*n* = 183), Rainbow Trout composed 15.6% of the catch (*n* = 165), and Smallmouth Bass composed 6.1% (*n* = 59). Largescale Sucker *Catostomus macrocheilus,* Northern Pikeminnow (NPM), and Black Bullhead *Ameiurus melas* composed 23.2% (*n* = 244), 22.0% (*n* = 239), and 10.8% (*n* = 118) of the catch, respectively. We also captured a relatively small number of Mountain Whitefish *Prosopium williamsoni* (*n* = 18; 1.9%), kokanee salmon (*n* = 15; 1.5%), Largemouth Bass *Micropterus salmoides* (*n* = 5; 0.5%), Pumpkinseed *Lepomis gibbosus* (*n* = 8; 0.6%), and tiger muskellunge *Esox Lucius x E. masquinongy* (*n* = 1; 0.1%). Relative length-frequency histograms of all fish caught, by species, are shown in Figure 2.

During 2018, mean perch CPUE (± 90% C.I.) was 12 fish/gill-net pair (± 3), with an average of 7 fish/gill-net pair (± 3) greater than 250 mm (Table 4). Since 2012, when standardized monitoring began, mean CPUE has ranged from 12 to 49 fish/gill-net pair, and averaged 28 fish/gill-net pair (Figure 3). Mean CPUE of perch greater than 250 mm has averaged 12 fish/gill-net pair (range: 7 to 19; Figure 4). Mean CPUE values for all perch, and perch greater than 250 mm, in 2018 were the lowest values we have observed since the most recent restoration project was completed from 2004 to 2006. Mean proportion of perch greater than 250 mm per site in 2018 was 58% (4). That value has ranged 28% to 80% since 2012, and averaged 55%. Mean proportion of perch greater than 250 mm per site has increased in recent years as a result of relatively lower numbers of small perch caught (Figure 5). Catch curves indicate a reduction in age-specific survival from age-2 to age-3 in recent years (Figure 6). Mean length of perch in 2018 was 263 mm (

Figure 7) and mean relative weight was 91. PSD-Q for perch in 2018 was 72, and RSD-250, RSD-300, and RSD-380 were 56, 46, and 0, respectively (Table 5). PSD-Q and RSD values were all relatively average when compared with our trend dataset from 2012 to present.

Mean CPUE for all NPM was 16 fish/gill-net pair (± 6), with an average of 4 fish/gill-net pair (± 2) greater than 350 mm (Table 4). Since 2012, mean CPUE for all NPM has ranged from 9 to 23 fish/gill-net pair, and averaged 17 fish/gill-net pair (Figure 8), and mean CPUE of NPM greater than 350 mm has ranged 4 to 7 fish/gill-net pair, and averaged 6 fish/gill-net pair (Figure 9). The mean percentage of NPM caught greater than 350 mm in 2018 was 27% (Table 4), which is relatively low when compared to our dataset from 2012 to present, which has ranged 24% to 47%, and averaged 34%. NPM mean length was 317 mm and ranged 170 mm to 549 mm (Figure 10).

We collected over 165 Rainbow Trout in 2018, of which 15 appeared to be of natural origin (Table 6). Natural origin trout ranged in length from 175 to 495 mm (Figure 11), with mean relative weight and condition factor of 94 and 1.03 respectively. Hatchery Rainbow Trout ranged in length from 310 mm to 525 mm, with a mean condition factor of 1.18. Mean length of this year's October stocked fish was 277 mm and spring-stocked fish averaged 375 mm. We caught a large number of hatchery trout in 2018 due to the stocking of catchable Rainbow Trout just prior to our October survey; therefore, not all hatchery trout less than 350 mm were counted as mean catch had little value in trend monitoring.

We collected 59 Smallmouth Bass in 2018 that ranged in length from 195 to 455 mm (Table 7, Figure 12), with a mean relative weight of 102. PSD-Q was 75, and RSD-400 was 17. Mean catch rate per site was 4 fish/net pair (±3).

DISCUSSION

Mean CPUE for perch in 2018 was similar to 2017, but significantly lower than in all other years since standardized monitoring began in 2012. It is unclear if angler catch rates have been affected, because representative index creel surveys have not been conducted since 2016. Despite the lack of recent creel survey information, we assume that angler catch rates have decreased corresponding to the decrease in abundance indices (i.e. mean CPUE). Also, the mean CPUE for perch greater than 250 mm declined in 2018; however, the difference was not significant when compared to previous years, with the exception of 2012. PSD-Q still remained relatively high in 2018, but incremental relative stock densities (RSD-250, RSD-300, and RSD-380) all declined from 2017, indicating a shift in size structure toward smaller perch, and fewer large perch. It would be beneficial to develop a periodic, standardized creel monitoring program to understand how changes in size structure and perch abundance, indexed by CPUE, are affecting perch fishing in Lake Cascade. Implementation of such a program will help provide more insight into whether and when management action is required to improve fishing conditions.

The observed decline in overall perch abundance since 2014, and relative decline in size quality was anticipated. Changes in perch size distribution from 2013 to 2018 and steep declines in survival rates of fish less than 200 mm indicate lower recruitment of fish greater than 250 mm in recent years. Although our catch curves are based on estimated ages; and thus are not entirely reliable, they indicate that once perch reach approximately age-4 (or 250 mm), annual mortality rates drop to low levels. This means survival rates of younger perch (age-0 through age-3) will have a large, long-term impact on the status of the fishery. Previous studies suggest mortality rates are highest on age-0 and age-1 perch in Lake Cascade (Bennett 2004). High predation rates have likely been occurring on juvenile perch for the past decade in Lake Cascade, which will likely contribute to relatively poorer size structure of the perch population for several years to come; that is, until predation rates on juvenile perch are reduced. Prior to 2012, we routinely sampled young perch (age-0 through age-2) via trawls during fall. However, these trawling surveys were discontinued, so data are lacking to determine how juvenile abundance, recruitment, and survival corresponds to the quality of the perch fishery over the long-term. Re-establishing trawling surveys on an annual basis will help provide insight into the future quality of the perch fishery in Lake Cascade.

NPM predation on juvenile perch is considered the major threat to the status of the Cascade perch fishery, and requires continuous monitoring and periodic population reduction measures (Allen et al. 2009). The IDFG Fisheries Management Plan specifies that adult Northern Pikeminnow abundance should be aggressively reduced if mean CPUE of NPM greater than 350 mm reaches or exceeds 10 fish/gill-net pair, or the percent of NPM caught greater than 350 mm reaches or exceeds 75% during fall gill-netting (IDFG 2018). Mean CPUE for all NPM in 2018 was slightly higher than in 2017, but did not differ significantly from any previous years, back to 2012. Mean CPUE of NPM greater than 350 mm did not change from 2016 and 2017, and was also not significantly different from any of the previous years. Additionally, the percent of NPM caught greater than 350 mm was lower in 2018 than in five of the past six years we have surveyed. Mean CPUE of adult NPM has dropped since 2015 when the last rotenone treatment to reduce spawning NPM was completed.

Overall NPM catch rates and catch rates of NPM greater than 350 mm are still well below the objectives outlined in the IDFG Fisheries Management Plan (IDFG 2018). Although these results do not raise a substantial immediate concern to initiate aggressive removal of NPM in the reservoir, these data may not be entirely reliable for determining when NPM suppression efforts are needed. We have seen nets become fully saturated with NPM on multiple occasions, which means relative abundance data from gill-netting surveys can be difficult to interpret. Perch abundance has declined over the past several years, and if perch recruitment does not increase in the near future, rotenone treatment in NPM spawning tributaries should be considered. In addition to treating the major NPM spawning tributary (North Fork Payette River), rotenone treatment in the other two large tributaries (Lake Fork Creek and Gold Fork River) may help provide further benefit to overall fishery quality. These rotenone treatments are relatively inexpensive and require little logistical effort, and ultimately provide added benefit to the future status of the entire sport fishery in Lake Cascade. Treating these three tributaries for several years to suppress multiple generations of NPM in the lake should also be considered, as benefits to the sport fishery may then be longer-lived (Bennett 2004). Chemical treatments in several tributaries over consecutive years in the 1950s, 1960s, and 1970s, targeting both spawning NPM adults and emerging NPM fry, were very successful at improving juvenile perch and trout survival and improving the overall quality of the fishery.

It is likely that reduced survival and recruitment of juvenile perch over the past several years in Lake Cascade can also be, at least partially, attributed to cannibalism. Lake Cascade has been dominated by large numbers of perch greater than 250 mm for several years. Low mortality rates, abundant food resources, and low predation rates after the initial stocking of over 860,000 perch in 2004 through 2006 contributed to high survival to adulthood, which led to increased production of juveniles in 2009, 2010, and 2011. High survival of those 2009, 2010, and 2011 cohorts likely led to the abundance of large perch documented over the past several years, leading to three state records and two world records. Although these cohorts have significantly increased the quality of the fishery today, their continued high abundance over the past several years has likely contributed to decreased juvenile perch survival, via cannibalism. This is evident in the lack of recruitment that has followed behind the 2009, 2010, and 2011 cohorts of perch. As the number of perch greater than 250 mm declines, we expect predation pressure on small perch to decline, and we anticipate increased survival of juvenile perch, with two to three strong cohorts over the next two to three years.

Predation on juvenile perch by Western Grebe *Aechmophorus occidentalis* and White Pelicans *Pelecanus erythrorhynchos* is also likely in Lake Cascade. Western grebes have been documented to consume perch up to 200 mm (Ydenberg and Forbes 1988), and counts in recent years have been relatively high. Mean Western Grebe counts from 2004 through 2018 were 2,900 adults and ranged from 1,440 to 4,980 adults (IDFG unpublished data; Figure 13). Grebe trend counts at Cascade appear to be increasing. At this time, we are unsure if piscivorous birds are affecting perch recruitment substantially.

Rainbow Trout are, and have historically been, an important sport fishery in Lake Cascade. In a 1991 to 1992 creel survey, Janssen et al. (1994) estimated over 43,000 Rainbow Trout were caught in Lake Cascade. Gill net catch for hatchery Rainbow Trout varies greatly from year to year, which is likely due to time of stocking relative to time of gill-netting; therefore, relative mean catch has little meaning. Since 2015, we have been stocking larger, “magnum” (300 mm TL) Rainbow Trout in an attempt to increase survival. However, we have not observed an increase in holdover fish in our surveys since 2015. We currently stock approximately 100,000 hatchery Rainbow Trout in Lake Cascade annually, and exploitation evaluations suggest less than 10% of those fish currently return-to-creel (Cassinelli, 2016). Natural origin fish make up a significant portion of this fishery, and have been documented up to 745 mm TL in the lake. In late fall, natural-origin Rainbow Trout in Lake Cascade ascend the North Fork Payette River and overwinter, then continue to ascend as high as the city of McCall to spawn in spring. These adfluvial fish have become prized by local anglers, and offer a unique opportunity for the area. In 2014, fishing regulations were changed on the section of the North Fork Payette River between Lake Cascade and Payette Lake, from general bag limits to catch and release, from December 1 through the Friday before Memorial Day weekend to protect this unique resource. Further investigations should be conducted to learn more about this adfluvial component of the fishery, with emphasis on determining if and how productivity can be increased.

While bass are an important component of the sport fishery at Lake Cascade, gill-netting and electrofishing are not good indices of Smallmouth Bass population structure or abundance in Lake Cascade. Water conductivity is very low (15-20 µS), so electrofishing is not efficient, and gill nets are typically not set in ideal bass habitat due to logistical constraints. Several bass fishing tournaments are held annually at Lake Cascade, increasing the economic value of this fishery. There were eight bass club tournaments in 2018, of which Smallmouth Bass made up the majority of the catch, with a few occasional Largemouth Bass. Investigation and review of mandatory reports from fishing tournament organizers, in addition to exploitation tagging investigations, may be the best option for identifying trends in the bass population over time in the lake.

MANAGEMENT RECOMMENDATIONS

1. Re-establish annual trawling surveys for juvenile perch and determine whether results may provide insight into the future quality of the perch fishery.

2. Develop a standardized annual creel survey program for Lake Cascade to study trends in angler catch over time.

3. Continue annual monitoring of the sport fishery through fall gill-netting surveys. Determine when NPM population reduction efforts are needed to reduce predation on sport fish.

4. Continue stocking “magnum”-sized hatchery Rainbow Trout, and periodically evaluate return-to-creel of those fish.

5. Develop a study to learn more about movement and life history of natural origin Rainbow Trout in the reservoir.

6. Compile bass population trend data over time by evaluating catch rates and size information from mandatory fishing tournament reports. Estimate smallmouth bass catch and harvest using t-bar anchor tags.

Table 3. Total numbers of fish caught, relative weights and total length (TL) statistics by species collected with gill nets in Lake Cascade in October 2018.

Species	Number caught	% Total catch	Mean relative weight/condition	Mean TL (mm)	Min TL (mm)	Max TL (mm)
Yellow Perch	183	17.3	91/--	263	131	394
Northern Pikeminnow	239	22.7	--/--	317	170	549
Rainbow Trout (natural)	15	1.4	94/--	465	342	632
Rainbow Trout (hatchery)	150	14.2	--/1.18	329	210	537
Smallmouth Bass	59	5.6	105/--	340	190	454
Kokanee (October spawner)	15	1.4	95/--	333	180	388
Largemouth Bass	5	0.5	125/--	261	134	400
Largescale Sucker	244	23.1	--/--	470	176	649
Mountain Whitefish	18	1.7	107/--	340	240	444
Pumpkinseed	8	0.8	129/--	213	120	384
Tiger muskellunge	1	0.1	121/--	930	930	930
Black Bullhead	118	11.2	95/--	227	135	400
Grand Total	1,055	100				

Table 4. Total catch and mean CPUE with 90% confidence intervals of Yellow Perch, Northern Pikeminnow, Yellow Perch greater than 250 mm, and Northern Pikeminnow greater than 350 mm collected in Lake Cascade in 1991, 2003, 2005, 2008 and annually in October from 2012 through 2018.

	Yellow Perch				Northern Pikeminnow					
Year	Total catch	Mean CPUE (± 90% CI)	Mean CPUE >250 mm (± 90% CI)	% > 250 mm	Total catch	Mean CPUE (± 90% CI)	Mean weight (g)	Total catch > 350 mm	Mean CPUE > 350 mm (± 90% CI)	% > 350 mm
1991[1]	1,361	109/net	Na	60	795	31/net	618	673	na	85
2003[2]		1.2/net	0.3	25	na	na	979	651	9.9 sink, 3.3 float	96
--Yellow Perch Restoration Project (2004 - 2006)--										
2005[3]	na	7/net	na	15	na	na	na	na	na	7
2008[4]	na	27/net[4]	18 ± /net[4]	66	na	5/net[4]	NA	na	1/net[4]	11
2012[5]	608	40 ± 11	18 ± 4	45	351	23 ± 10	413	110	7 ± 3	31
2013	739	49 ± 28	13.5 ± 23	28	213	14 ± 7	391	70	5 ± 2	33
2014	441	29 ± 10	19 ± 32	66	335	22 ± 10	441	122	8 ± 4	36
2015	465	31 ±10	14.5 ± 5.5	47	275	18 ± 6	445	118	8 ± 4	43
2016	400	27 ± 8	17 ± 7	63	243	16 ± 6	438	58	4 ± 2	24
2017	188	12.5 ± 4	10 ± 5	80	139	9 ± 6	502	65	4 ± 2	47
2018	183	12 ± 3	7 ± 3	58	239	16 ± 6	419	64	4 ± 2	27

1. 15 sinking experimental nets, 11 floating experimental nets, one net per site.
2. 80 experimental floating and sinking gill nets, one net per site.
3. 17 sinking IDFG experimental nets, one net per site.
4. 9 experimental nets; three floating and six sinking, one net per site.
5. Catch per site, 15 sites, one floating and one sinking net/site (2012 through 2018).

Table 5. Proportional (PSD) and incremental Relative Stock Densities** (RSD) for 250 mm, 300 mm, and 380 mm Yellow Perch collected annually with gill nets in Lake Cascade in October 2012 through 2018.

Year	PSD	RSD-250	RSD-300	RSD-380
2012	69	45	27	1
2013	66	27	13	1
2014	89	65	32	1
2015	57	47	27	2
2016	78	63	42	3
2017	83	77	58	4
2018	72	56	46	0

**Stock and quality lengths = 130 and 200 mm respectively.

Table 6. Total catch, mean CPUE, mean and range of total lengths of holdover (> 399 mm) and natural Rainbow Trout collected annually during fall fish surveys in October 2014 through 2018. 15 sites were sampled in all years.

Year	Total catch[1] hatchery holdover/ natural	Mean length holdover/ natural (mm)	Hatchery holdover length range (mm)	Natural length range (mm)
2014	26/6	455/522	405-515	485-555
2015	27/4	479/437	405-565	385-485
2016	23/31	452/460	405-545	305-745
2017	8/11	458/360	405-525	170-490
2018	28/15	464/464	405-535	345-635

Table 7. Smallmouth Bass total catch, mean CPUE, proportional stock densities (PSD) and incremental Relative Stock Densities* (RSD-400 and 480 mm) of Smallmouth Bass collected with gill nets in Lake Cascade in October 2012 through 2018.

Year	Total catch	Mean catch (± 90% CI)	PSD	RSD-400	RSD-480
2012	64	5 ± 3	69	32	2
2013	38	2.5 ± 5	95	53	3
2014	67	4.5 ± 3	72	27	0
2015	142	9.5 ± 5	83	22	1
2016	65	4 ± 3	93	36	0
2017	41	3 ± 2	88	46	5
2018	59	4 ± 3	75	17	0

* Stock and quality lengths = 180 and 300 mm, respectively

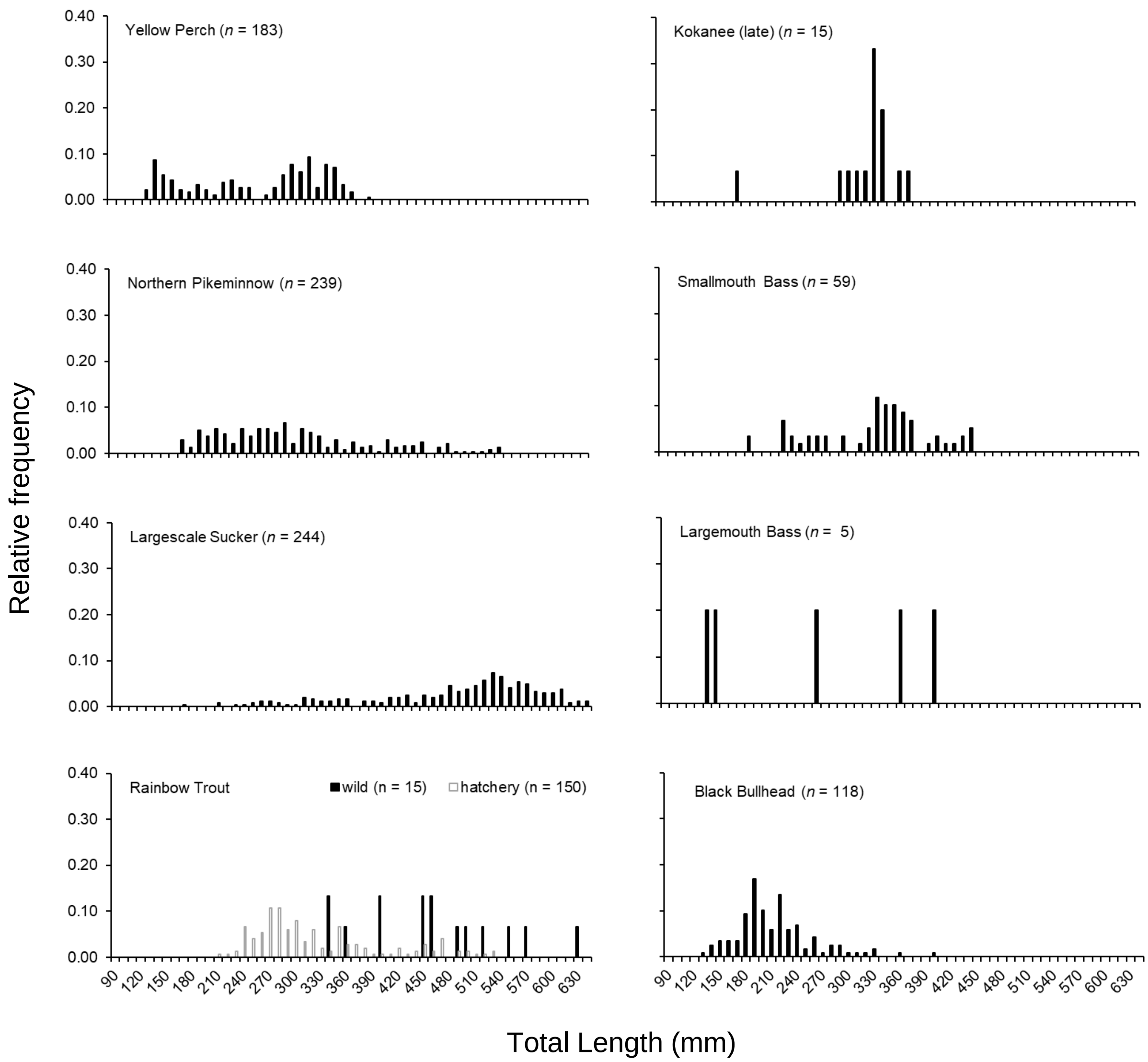

Figure 2. Relative length-frequency histograms by species of fish collected with gill nets in Lake Cascade in October 2018.

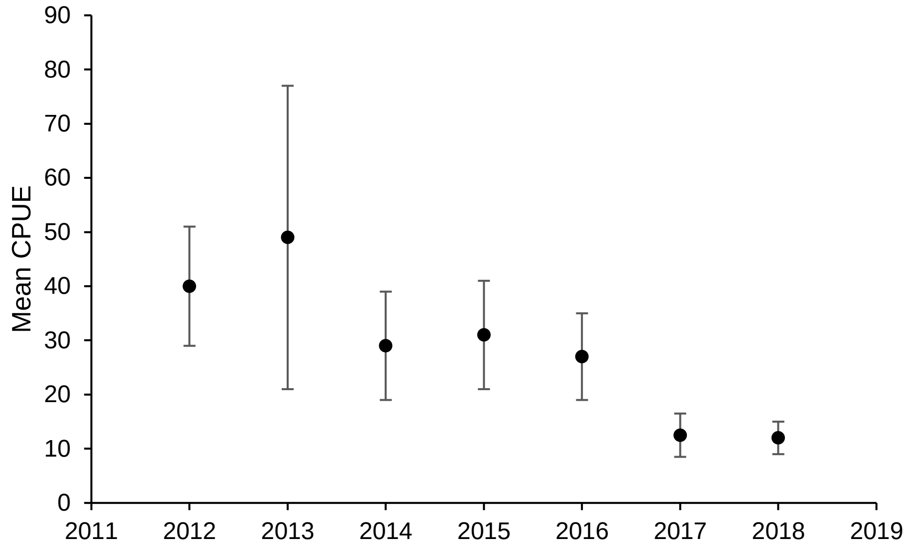

Figure 3. Mean CPUE with 90% confidence intervals of all Yellow Perch collected with gillnets in Lake Cascade in October 2012 through 2018.

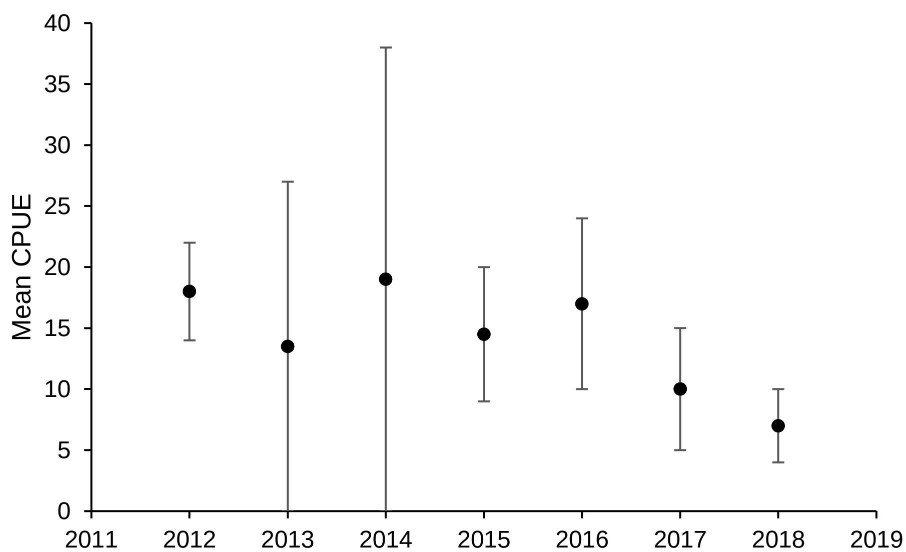

Figure 4. Mean CPUE with 90% confidence intervals of Yellow Perch greater than 250 mm collected with gillnets in Lake Cascade in October 2012 through 2018.

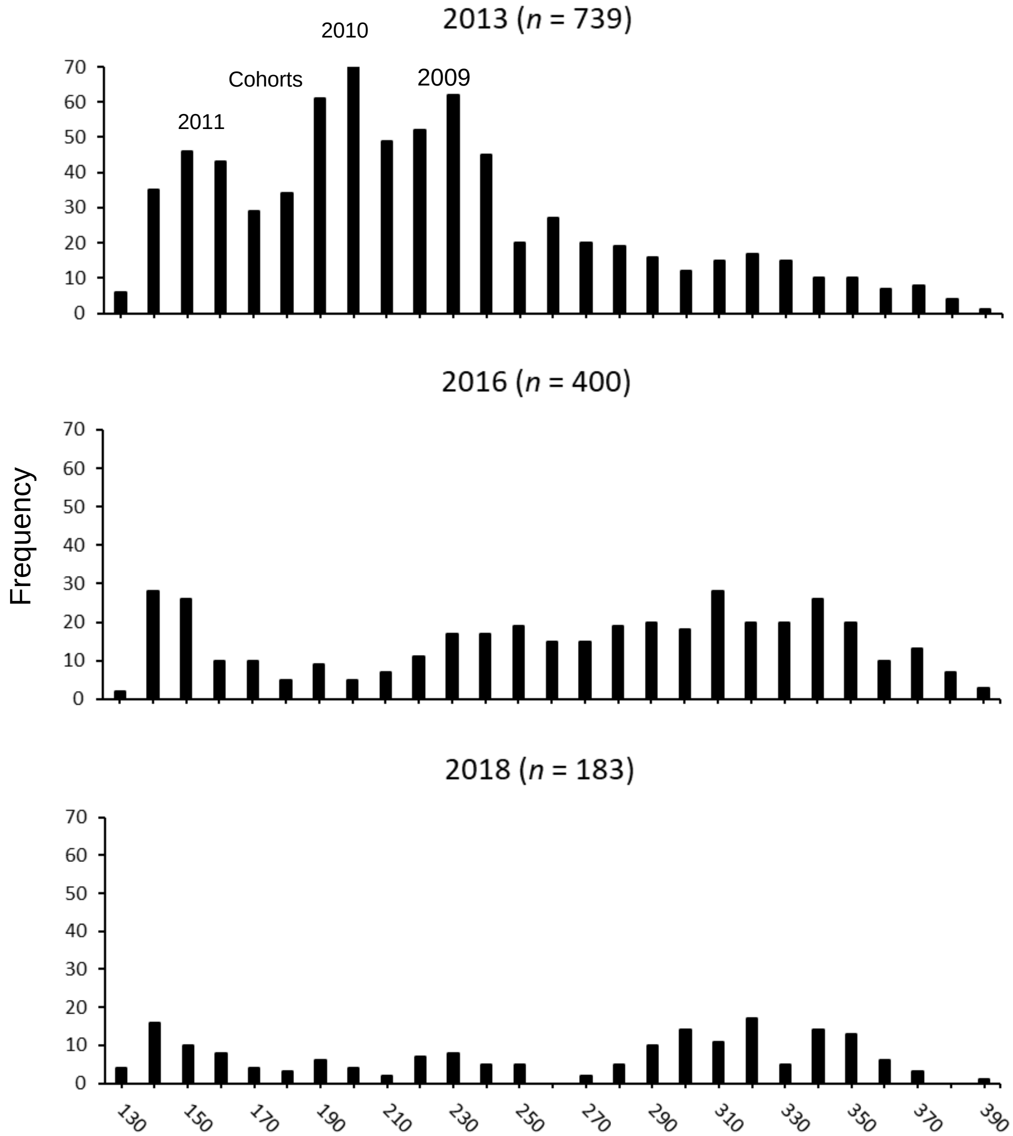

Figure 5. Length-frequency histograms of Yellow Perch collected with gill nets in Lake Cascade in October 2013, 2016, and 2018.

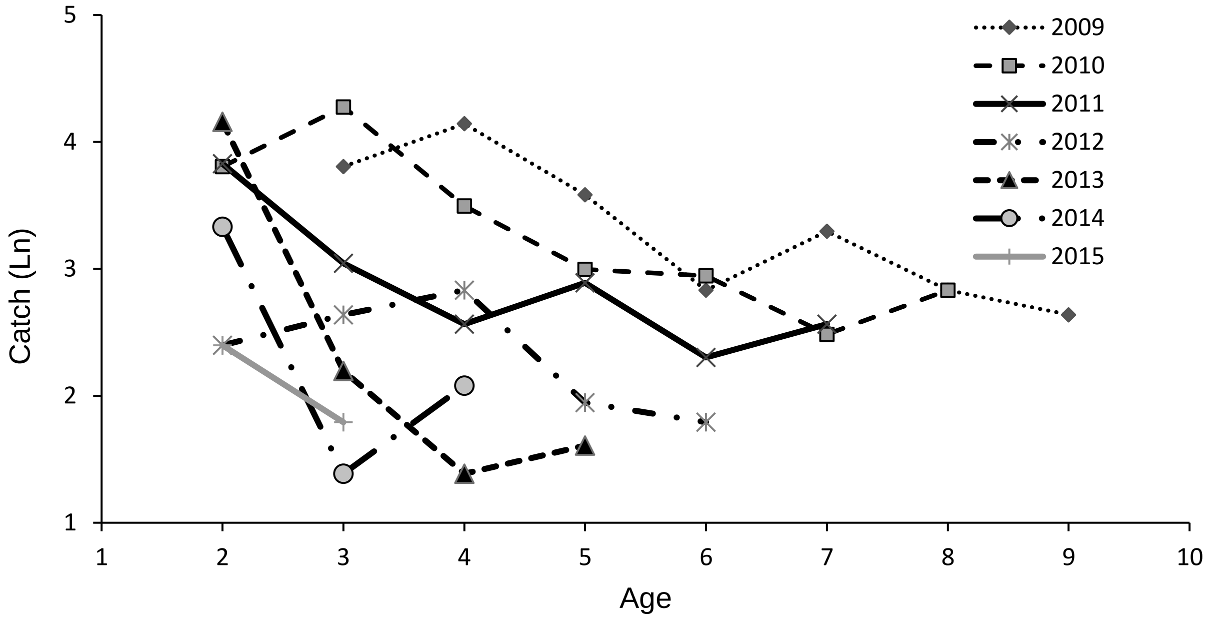

Figure 6. Yellow Perch catch curves by cohort and age collected with gill nets in Lake Cascade in October 2012 through 2018.

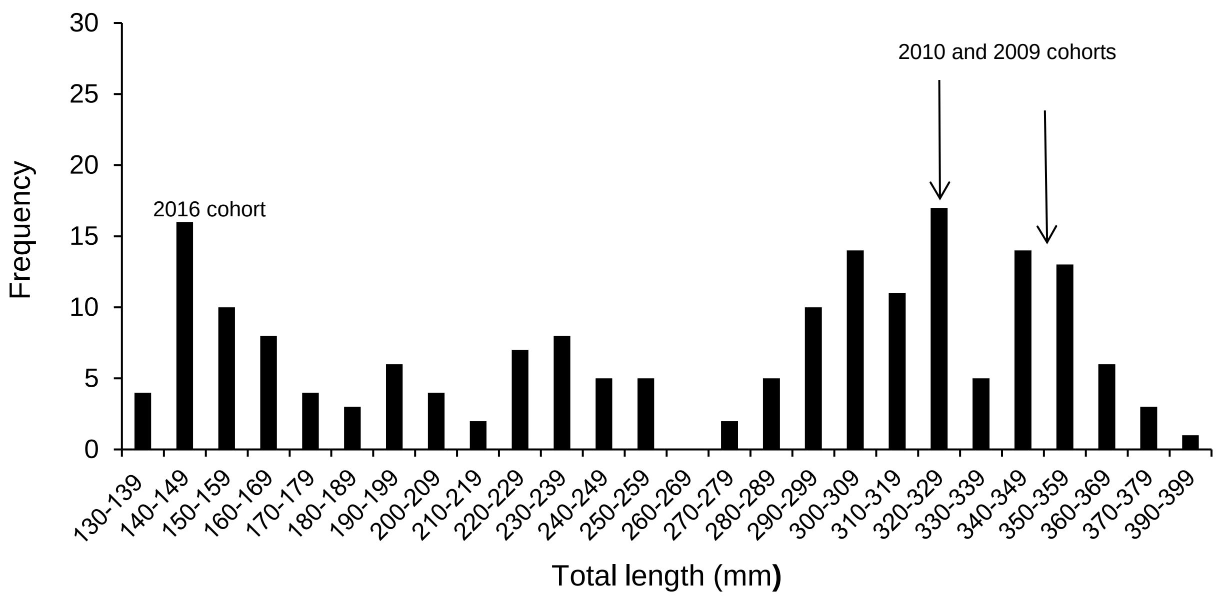

Figure 7. Length-frequency histogram and estimated ages of Yellow Perch collected with gill nets in Lake Cascade in October 2018.

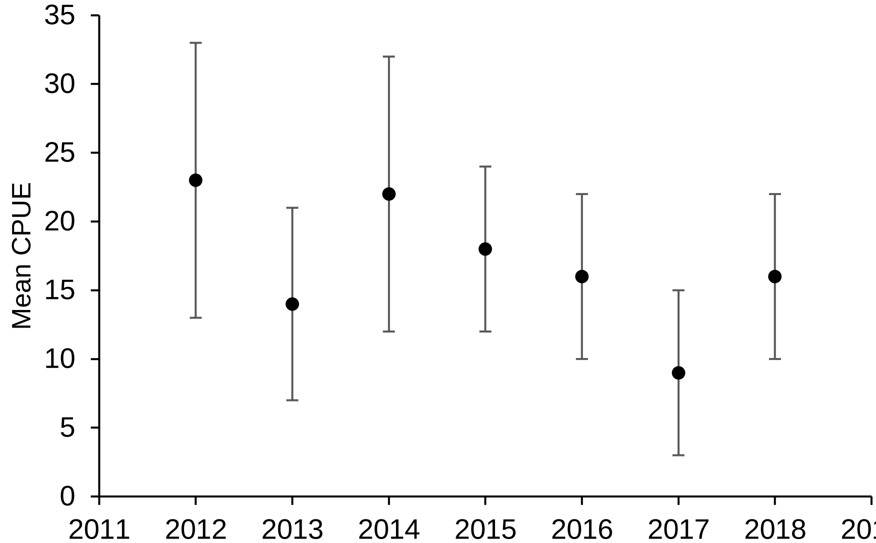

Figure 8. Mean CPUE with 90% confidence intervals of all Northern Pikeminnow collected with gillnets in Lake Cascade in October 2012 through 2018.

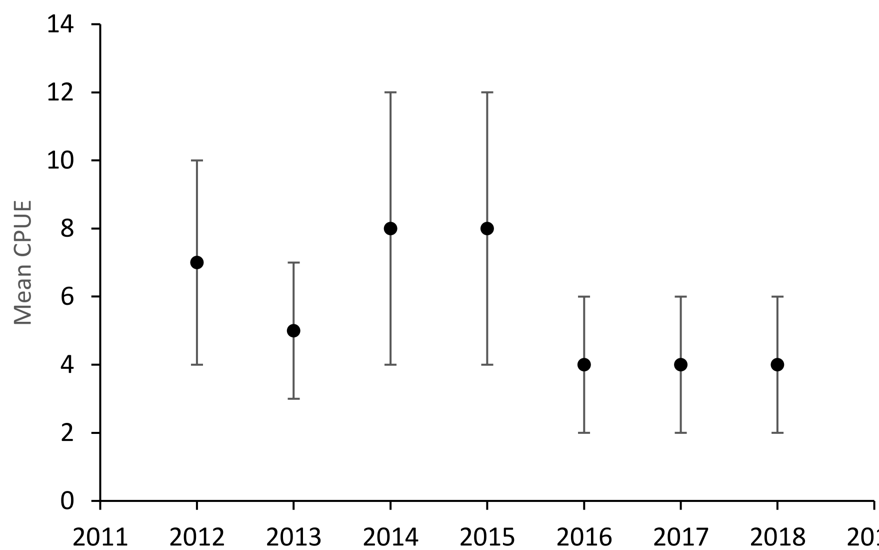

Figure 9. Mean CPUE with 90% confidence intervals of Northern Pikeminnow greater than 350 mm collected with gillnets in Lake Cascade in October 2012 through 2018.

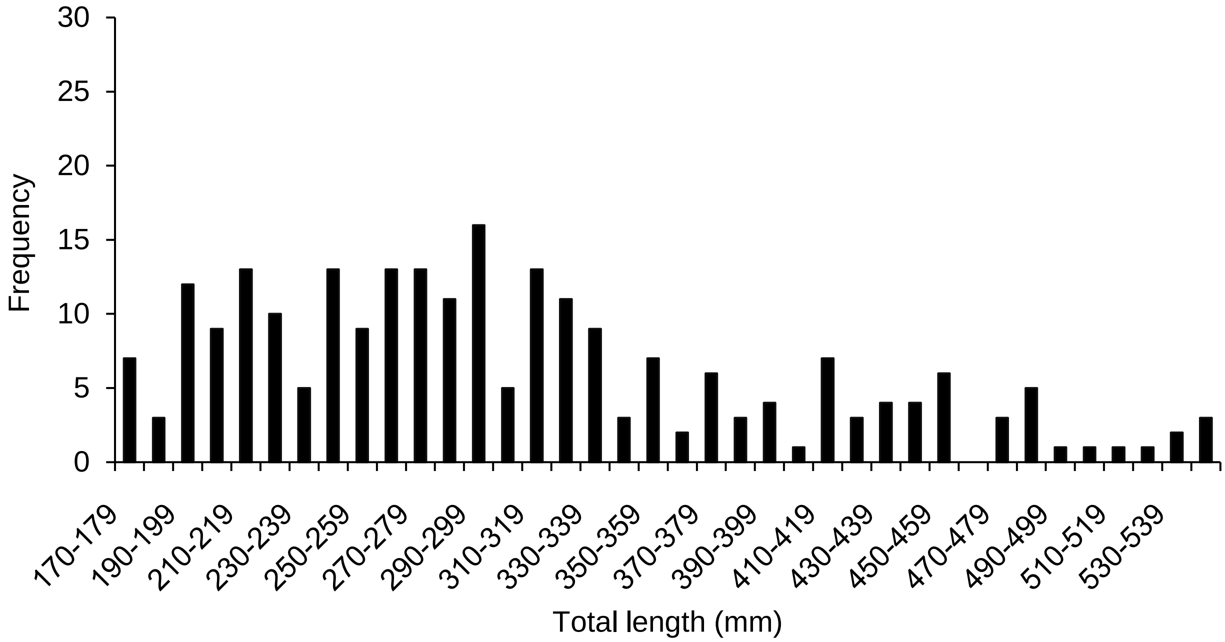

Figure 10. Length-frequency histogram for Northern Pikeminnow (n = 239) collected with gill nets in Lake Cascade in October 2018.

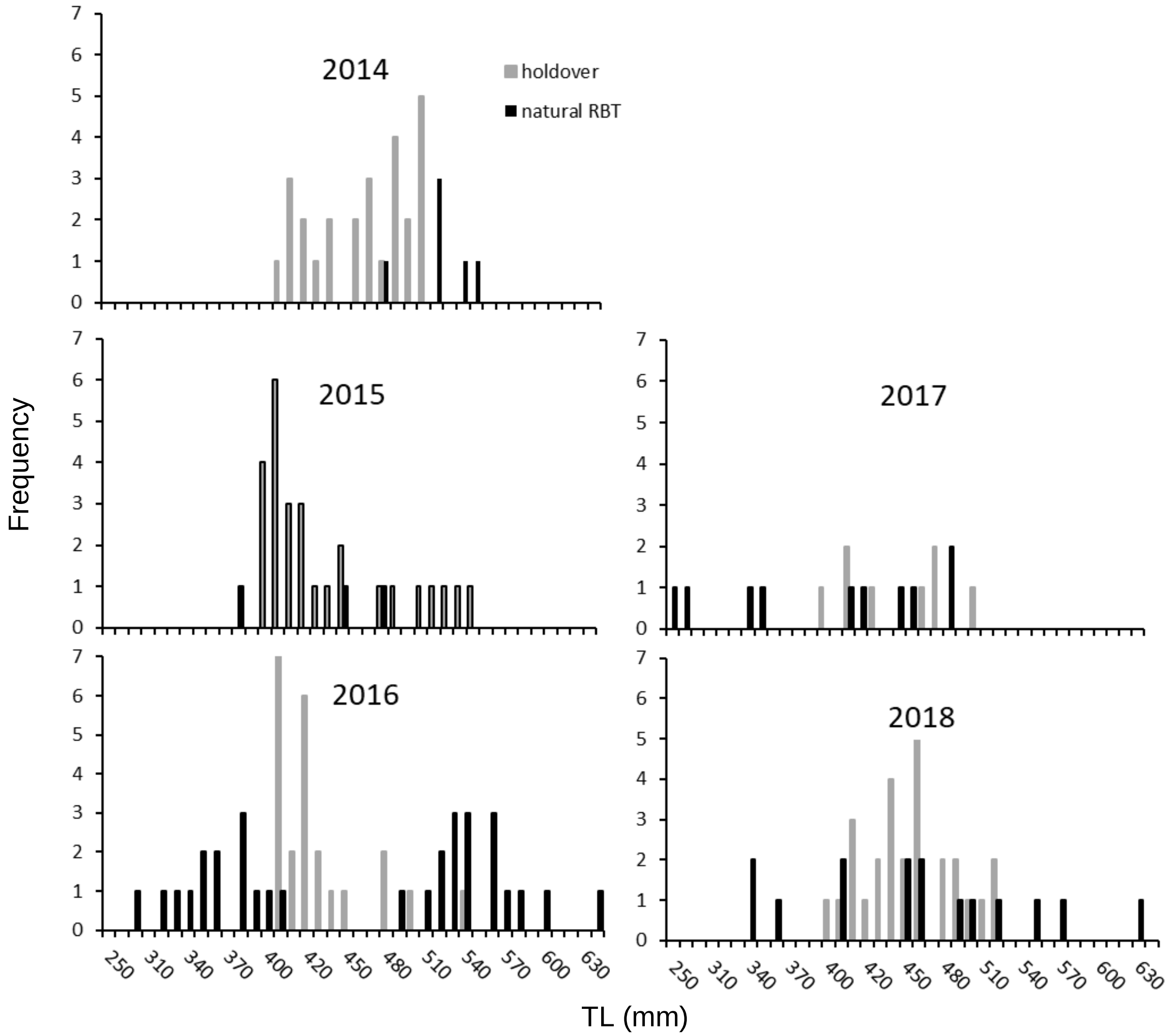

Figure 11. Length-frequency histograms of hatchery holdover (>399 mm) and natural Rainbow Trout collected with gillnets in Lake Cascade in October 2012 through 2018.

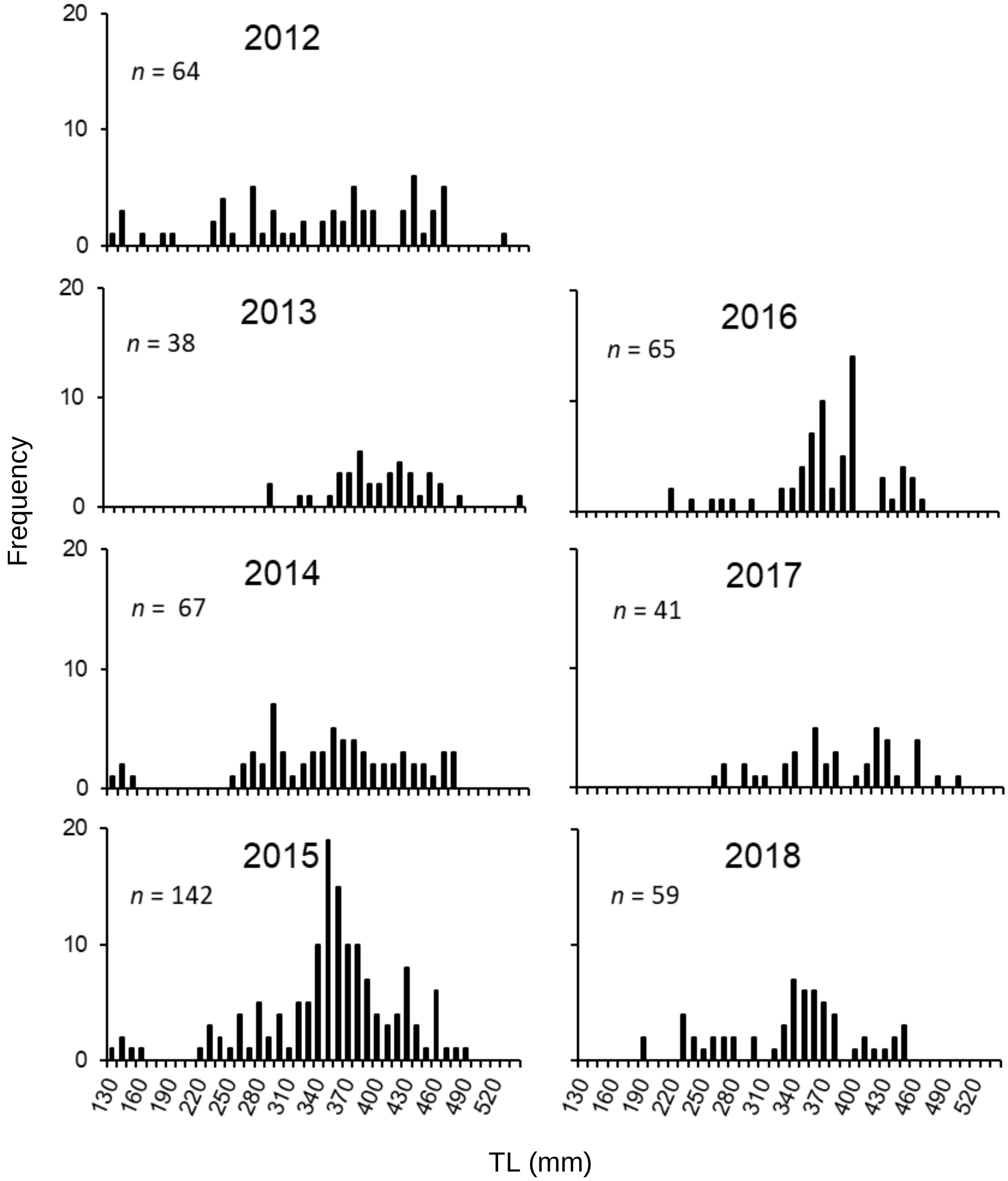

Figure 12. Length-frequency histograms for Smallmouth Bass collected with gill nets in Lake Cascade in October in 2012 through 2018.

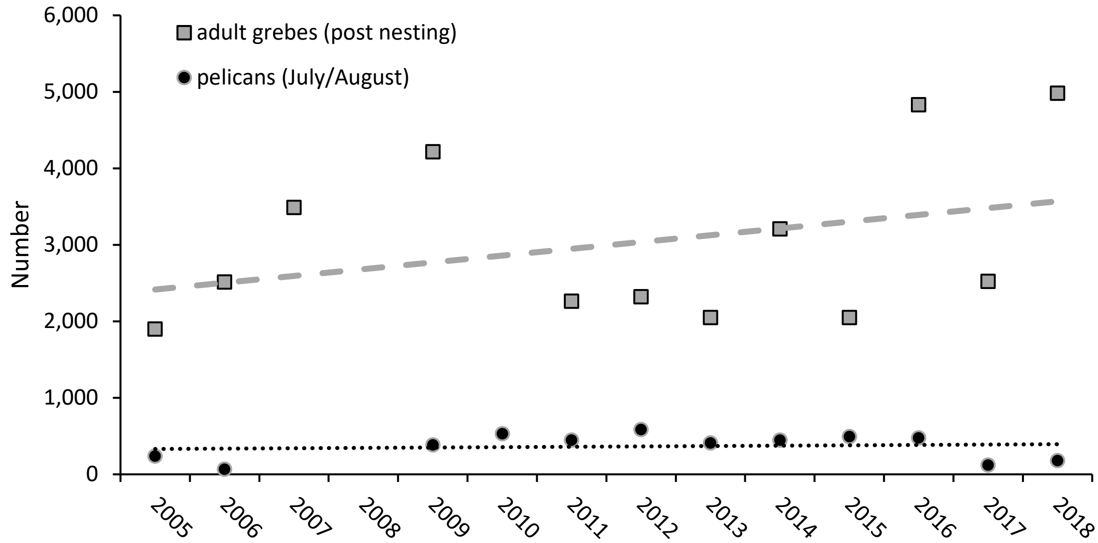

Figure 13. Adult Western Grebe (*Aechmophorus occidentalis*) and American White Pelican counts on Lake Cascade from 2004 through 2018 (IDFG McCall subregion, unpublished data).

LAKE CASCADE HOLIDAY ANGLER COUNTS

ABSTRACT

Holiday angler counts have been conducted annually at Lake Cascade since 1996, as an index to assess trends in angler effort. Each year on Memorial Day, Independence Day, and Labor Day, we count shore anglers and fishing boats on Lake Cascade to assess angling effort relative to previous years. In 2018, we counted 22 shore anglers and 37 boats on Memorial Day, 19 shore anglers and 59 boats on Independence Day, and 28 shore anglers and 59 boats on Labor Day. Mean holiday index counts in 2018 for shore anglers and number of fishing boats were 23 and 52, respectively, for a combined mean index count of 75. The average of mean index counts from 2000 to 2004 (prior to fishery restoration) was 26.6, whereas the average of mean index counts from 2006 to 2018 (post-restoration) is 65.0. In general, angler counts have increased since the fishery restoration efforts in 2004 through 2006, and the 2018 index count is the third highest value observed in the nine years since the fishery restoration project was completed in 2006.

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INTRODUCTION

In order to monitor long-term trends in angling effort on Lake Cascade, we have conducted annual boat and shore angler counts on Memorial Day, Independence Day, and Labor Day each year since 1996. These counts serve as an index of trends, and are a relatively inexpensive way to track changes in angling effort between years when more comprehensive creel surveys were not completed. These holiday angler counts coincidentally started just prior to the collapse of the Yellow Perch *Perca flavescens* (perch) fishery in the early 2000s (see Lake Cascade Fall Gill-netting Survey section of this report for historical background on the fishery). These index counts have given managers a relatively inexpensive tool to monitor changes in angling pressure prior to and during the fishery collapse, as well as after the perch fishery restoration project was completed (2004-2006). We completed holiday angler counts again in 2018 to add to the long-term trend dataset.

OBJECTIVES

1. Conduct holiday index counts to add to long-term trend angler effort data in Lake Cascade.

METHODS

The total number of fishing boats (boats – not anglers) and number of shore anglers were enumerated on Memorial Day, Independence Day, and Labor Day, on Lake Cascade in 2018. A single count was conducted each day, beginning at 10:00 AM and ending at approximately 1:00 PM, or when the entire lake was completed. Surveyors in 2018 used a motorized boat to travel the entire lake and counted both the number of fishing boats and number of shore anglers. Prior to 2016, these counts were conducted from a fixed-wing aircraft. We averaged the counts of fishing boats and shore anglers across all three surveys to derive the index count for 2018, as has been done in previous years.

RESULTS

On Memorial Day, we counted 22 shore anglers and 37 boats, on Independence Day we counted 19 shore anglers and 59 boats, and on Labor Day we counted 28 shore anglers and 59 boats. Mean index counts for shore anglers and fishing boats were 23 and 52, respectively (Table 8, Figure 14). The average of mean index counts from 2000 to 2004 (prior to restoration) was 26.6, whereas the average of mean index counts from 2006 to 2018 (post-restoration) is 65.0 (Table 8, Figure 14). The 2018 index count is the third highest value observed in the nine years since the fishery restoration project was completed in 2006.

DISCUSSION

The combined holiday index count in 2018 was the highest count since 2015, and 2018 boat count was the highest recorded since 2014. In general, angler counts have increased since the perch restoration efforts in 2004 through 2006. Although counts have fluctuated up and down since 2008, those trends may not necessarily be indicative of trends in angler effort. With only three days of counts for the entire year, inclement weather on count days may have a significant influence on some yearly means and should be recorded in the future to help determine whether this is a factor. Previous count data did not include weather conditions at the time of the survey. In any case, the 2018 index count is the third highest value observed in the nine years since the fishery restoration project was completed in 2006, and therefore indicates a relatively high amount of fishing effort this year.

We assume the amount of angler effort at Lake Cascade is directly correlated to angler success. That is, when fishing is good, more anglers come to fish the lake. However, angler counts are not necessarily correlated with the quality of perch fishing, only. Bass anglers have also increased on Lake Cascade in recent years, which may offset a reduction in effort due to any decrease in the quality of perch fishing. Gathering angler catch rate and target species data to supplement index counts/effort data is necessary to better understand what species are driving fishing effort and inform management of the fishery. The last comprehensive creel surveys conducted at Lake Cascade were in 2016 and 2009. Conducting comprehensive creel surveys is important, both for collecting angler catch rate information, and to ensure holiday index counts are accurately representing overall annual angling effort. We recommend that repeatable creel methodology be developed for conducting comprehensive surveys once every three to five years at Lake Cascade. Creel surveys should focus on collecting angler effort, catch, and harvest data, as well as target species data to inform relative importance of each species' contribution to the overall value of the fishery. In addition, recording weather and ice conditions while conducting creel surveys should help us determine how much these factors affect angler effort. For example, ice conditions were poor and unsafe in 2016, which may have contributed to low ice fishing angler effort that year. Future analysis of these data should allow us to more accurately assess trends in angler effort and catch, regardless of weather conditions at the time of holiday index counts.

MANAGEMENT RECOMMENDATIONS

1. Continue holiday index angler counts to monitor trends in angler effort.

2. Develop repeatable methodology for comprehensive creel surveys to be conducted every three to five years.

3. Record weather conditions during creel/ angler effort surveys.

Table 8. Mean boat and shore angler counts on Lake Cascade on three major holidays including Memorial Day, July 4th, and Labor Day, in 1982, 1991, 1992, 1996 - 2010, and 2014 - 2018 with corresponding intensive creel survey angler hour estimates for 1982, 1991, 1992, 2009 and 2016.

	Mean holiday index counts		Creel surveyed angler hours (hours * 1000)			
Year	Mean boat count	Mean shore angler count	Boat anglers	Shore anglers	Ice anglers	Total pressure
1968[1]	--	--	32.3	27.4	n/a	59.7
1969[1]	--	--	38.7	27.9	n/a	66.6
1970[1]	--	--	53.3	24.8	n/a	81.3
1982	154	85	254.6	119.9	39.8	414.2
1986	n/a	n/a	212.8	128.2	50.8	391.8
1991	41.5	32	135.2	102	13.8	237.2
1992	52.5	28	144.2	177.3	61.7	321.5
1996	35	27	--	--	--	--
1997	36.5	19	--	--	--	--
1998	58	39.5	--	--	--	--
1999	27	31	--	--	--	--
2000	15	12	--	--	--	--
2001	11	12	--	--	--	--
2002	16.5	12	--	--	--	--
2003	17	6	--	--	--	--
2004	23	8.5	--	--	--	--
2005	28	12.5	--	--	--	--
2006	25	23	_	_	--	_
2007	24	28	_	_	--	_
2008	34	37	_	_	--	--
2009[2]	29	29	29.2	23.1	17.9	70.6
2010	22.5	22	--	--	--	--
2014	63	54	--	--	--	--
2015	44	42	--	--	--	--
2016[3]	22	16	31.8	22.1	11.1	65.0
2017	36	24	--	--	--	--
2018	52	23	--	--	--	--

[1] Creel survey from mid-April thru late October 1968, 1969, 1970
[2] Creel survey from May 15, 2009 thru May 30, 2010
[3] Creel survey from May 1, 2016 thru March 31, 2017

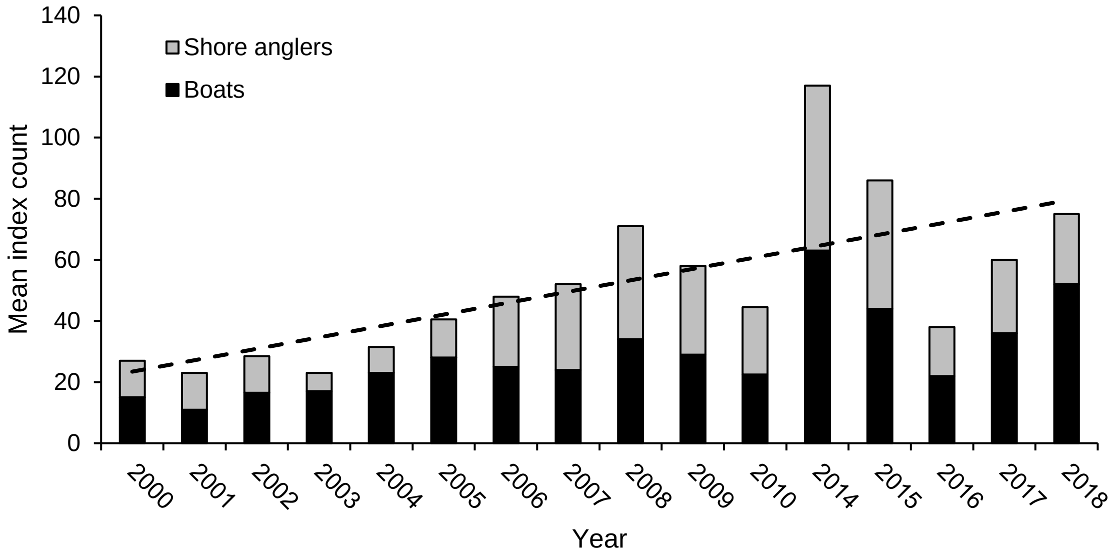

Figure 14. Mean index count of shore anglers and number of fishing boats on Lake Cascade on Memorial Day, Independence Day, and Labor Day, 2000 through 2018.

LAKE CASCADE YELLOW PERCH EXPLOITATION STUDIES

ABSTRACT

In order to evaluate angler harvest (exploitation) of Yellow Perch *Perca flavescens* (perch) in Lake Cascade, to determine whether more restrictive regulations are warranted, we have utilized the Tag-You're-It program since 2009. We collected and tagged 207 perch from May 1 through June 14, 2018, ranging in size from 250 to 378 mm and averaging 310 mm. We had 19 tags returned from harvested perch through April 2019, resulting in an estimated harvest rate (± 90% CI) of 17% (± 9). In addition to fish that were tagged in spring 2018, anglers also reported catching perch tagged in 2009, 2013, and 2015; nine, five, and three years since they were tagged, respectively. Annual first-year perch exploitation rates (May through April) in Lake Cascade since 2009 have ranged from a low of 7% (2015) to a high of 17% (2009 and 2018), with an overall mean through 2018 of 14%, with the majority of perch harvest occurring in May through July. Fishing mortality on adult perch in Lake Cascade appears to be very low, and fish seem to be reaching maximum age and dying of old-age, before being harvested. The data gathered through this tagging and exploitation evaluation indicate harvest restrictions for perch on Lake Cascade are not warranted.

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INTRODUCTION

As the quality of the Yellow Perch *Perca flavescens* (perch) fishery in Lake Cascade has improved over the last decade and a half, angling pressure has increased (see Lake Cascade Holiday Angler Counts section, this report). Current fishing regulations for Lake Cascade do not restrict harvest of perch. Classified under “all other fish species”, perch in Lake Cascade have no bag, size, or possession limits. Many anglers who fish for perch in Lake Cascade have expressed concerns that unrestricted harvest may pose a threat to the future quality of the perch fishery, and have suggested that IDFG adopt restrictive bag and possession limits to prevent overharvest. In order to evaluate angler harvest (exploitation) of perch in Lake Cascade, we have utilized the Tag-You’re-It program (Meyer, et al. 2012) since 2009 to determine whether more restrictive regulations are warranted, The data gathered through this tagging and exploitation evaluation effort will help managers determine whether harvest restrictions could improve the fishery.

METHODS

We used standard IDFG lake survey trap nets described in (IDFG 2012) set at various locations throughout the lake in the spring, to collect spawning perch large enough to be vulnerable to harvest (larger than 250 mm TL). Trap net locations were chosen non-randomly, and were not recorded, but were dispersed over a variety of habitats and locations throughout the lake. Traps were attached to or very near shoreline at locations where there was a smooth lake bottom, sloping to a minimum depth equal or greater than the height of the trap frame (1.8 m) and a maximum depth of 5 m when the net was fully extended and sitting on the bottom. Perch were measured to the nearest mm and tagged with a bright orange T-bar anchor tag between the vertebral skeleton and the dorsal fin base. Each unique tag number was entered into the “Tag-you’re-it” database, along with the TL of each fish. Methods utilized to determine exploitation rates of tagged fish are presented in Meyer et al. (2010).

To estimate single-year exploitation in 2018, we included all tag returns reported through April 2019, using an estimated tag loss rate of 1.2% and an angler reporting rate of 58.5% (Meyer, et al. 2012). For all previous years reported, we calculated single-year exploitation using the same adjusted rates.

RESULTS

We collected and tagged 207 perch from May 1 through June 14, 2018. Tagged fish ranged in size from 250 mm to 378 mm and averaged 310 mm (Figure 15).

We had 19 tags returned from harvested perch through April 2019 (Table 5). No tags were reported from perch caught and released. Estimated harvest rate (± 90% CI) on perch tagged in spring 2018 was 17% (± 9) through April 2019. In addition to fish that were tagged in spring 2018, anglers also reported catching perch tagged in 2009, 2013, and 2015 (Table 6). First and second year in-lake exploitation rates are shown in Table 6. Annual perch exploitation rates (May through April) in Lake Cascade since 2009 have ranged from a low of 7% (2015) to a high of 17% (2009 and 2018), with an overall mean through 2018 of 14%. The majority of perch harvest in Lake Cascade occurs in May through July (Figure 16).

DISCUSSION

Issermann, et al. (2005) states that there is little information available in the literature regarding Yellow Perch exploitation rates in recreational fisheries, but that reported rates are generally less than 30%, but may exceed 60% in some cases. In Lake Cascade, perch exploitation rates are comparatively much lower than these reported values, averaging 14% for all tagging years through 2018, and ranging from a low of 7% (2015) to a high of 17% (2009 and 2018). These estimated exploitation rates are low enough that we believe fishing mortality has very little impact on perch abundance in Lake Cascade. We do not have estimates of natural mortality for perch in Lake Cascade, but high levels of mortality on age-0 through age-1 perch in Lake Cascade have been previously documented and attributed to predation by Northern Pikeminnow (Bennett 2004). October fisheries surveys and resulting perch length-frequency data indicate high mortality rates at the age-0 to age-1 life stage since 2014. Catch curves developed using annual fall gill-netting surveys (see Lake Cascade Fall Gill-netting Survey section this report), also suggest mortality is high during those early life stages, but that once perch reach approximately age-4, or 225 mm in length, total mortality is relatively low. This emphasizes the importance of finding ways to increase perch survival in early life stages to increase abundance of adult perch over the long term, thereby increasing the quality and value of the perch fishery in Lake Cascade.

Survival of tagged perch and tag retention in Lake Cascade appear to be high, as we receive tag returns for several years after tagging. Tags placed in perch in spring 2009 were returned through spring 2018, and tags placed in 2013 were returned through 2018 (Table 5). Of 499 tags placed in perch in 2009, 139 (28%) have been returned through spring 2018. One tag placed in a 275 mm perch in the spring of 2009 was returned in May 2018. Ageing data in 2009 estimated that fish to be 4 - 5 years old at the time of tagging (Janssen, et al. 2011) and 13 - 14 years old when the tag was returned (nine years at large). This is very old for Yellow Perch. Scott and Crossman (1973) report that maximum age for Yellow Perch is usually age-9 or -10. This further suggests that both fishing and natural mortality on adult perch in Lake Cascade are very low, and many fish are reaching maximum age and dying, before being harvested. Future effort should be made to help anglers better target these perch while they are in the reservoir, so they are harvested rather than dying of old age.

The exploitation evaluations we have conducted for perch in Lake Cascade during the past decade have also given us some insight into when (what time of year) most perch are caught. The majority of tags are returned May through July, with two other peaks in January/February (ice fishing) and September (Figure 16). The January/February ice fishing period is very popular as perch are predictable and return to many of the same locations year after year. Both state and world record Lake Cascade perch (emphatically termed “jumbo perch”) were caught through the ice when perch are maturing for the spawn at ice out and maximum weight is obtained by females with large numbers of fully developed eggs. The May through early July peak corresponds to the period during and after perch spawning takes place when perch will typically gather in large schools and before weed beds become very extensive. Perch can become difficult to find and less predictable in late July and August. Future studies aimed at increasing angler catch rates for perch should focus on the late July and August period and the October/November period, when catch rates are currently relatively low. The March/April period will likely never be a feasible time period to increase perch catch rates, as this is the period when thin ice covers the majority of the reservoir and thus, conditions are not conducive to any type of fishing.

The ice fishery at Lake Cascade has always been very popular and typically runs from mid-December to early/mid-March. Tag return data suggests that approximately 17% of all perch harvest occurs during the ice fishery. While ice fishing is very popular, harvest is relatively low during this time. Reasons for the low harvest include weather and ice conditions, depth of snow and slush on the ice, and distance to the best fishing areas, some of which are miles from lake access sites. The large size of Lake Cascade (12,173 ha) and limited access during winter makes some of the best fishing locations accessible only to the most dedicated anglers on foot, skis or to those with snowmobiles and ATVs. In addition to fighting poor access conditions, most anglers pull a sled with them to carry all of the required gear, increasing the difficulty. All of these factors can severely limit the access to known fishing areas, forcing many anglers to fish close to access sites with poorer fishing success. In addition to difficult ice access issues at times, catch rates for perch on Lake Cascade can be quite low even for the experienced angler. Many anglers report "seeing" large numbers of perch on their fish finders and fish "looking/following" their lures or bait, but getting fish to bite can be difficult. Mean perch ice fishing harvest rates (fish/h) in 2015 and 2017 were 0.23 and 0.34 respectively (Janssen et al. 2016a; Janssen et al. 2016b). In order to increase angler success during the ice fishing season, we have started discussions with Lake Cascade State Park staff regarding creation of additional ice fishery access locations in better fishing areas. Improvements could be made to create new parking areas, and remove snow regularly from those areas to help improve angler access to better fishing locations during the ice fishing season.

MANAGEMENT RECOMMENDATIONS

1. Current fishing rules for Yellow Perch are appropriate based on low estimated exploitation rates, and restricted rules are not warranted at this time.

2. Combine telemetry data, forage information, and fishing technique knowledge to increase angler information/education outreach, and help increase catch rates for perch anglers throughout the year in Lake Cascade.

3. Work with State Park staff to improve angler access to prime fishing locations during the ice fishing season.

Table 9. Number of Yellow Perch exploitation tag returns by year tagged and year returned in Lake Cascade through April 2019.

	Year tags returned											
Year tagged	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Grand Total
2009	64	26	22	12	6	3	2		2	1	1	138
2013					41	26	12	7	5	10	2	103
2015							16	17	7	9	4	53
2018										14	5	19

Table 10. First and second year (May through April following year) Yellow Perch exploitation rates by year captured and tagged during spawning with trap nets in Lake Cascade.

Year	Number tagged	Number tags returned	1st year exploitation	2nd year exploitation
2009	379	37	17%	8%
2013	493	45	16%	7%
2015	445	18	7%	5%
2018	207	19	17%	---

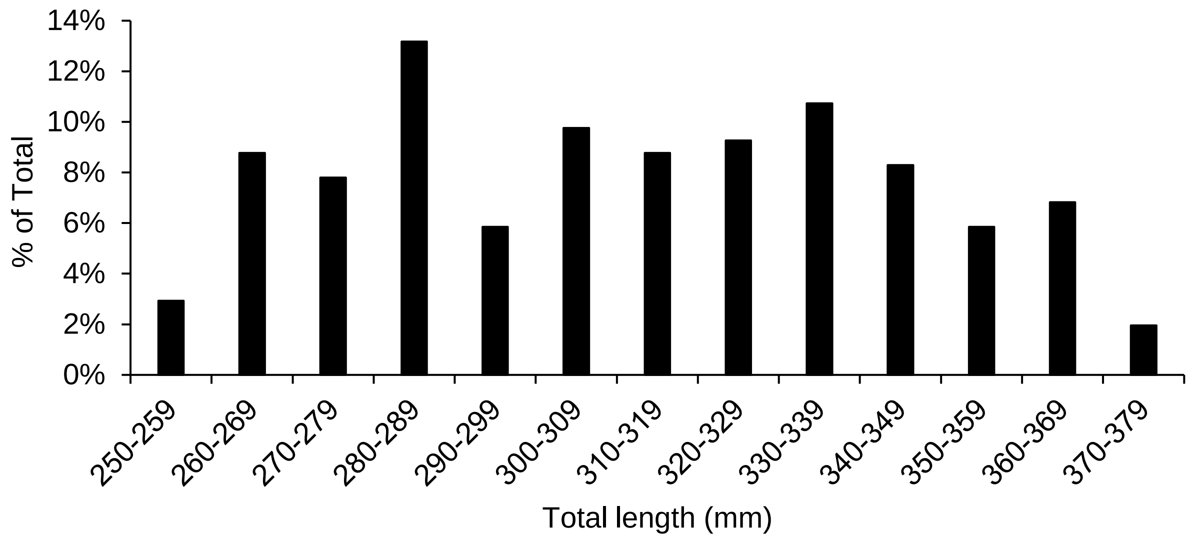

Figure 15. Percent of Yellow Perch tagged by 10-mm length groups collected with trap nets in Lake Cascade in May 2018.

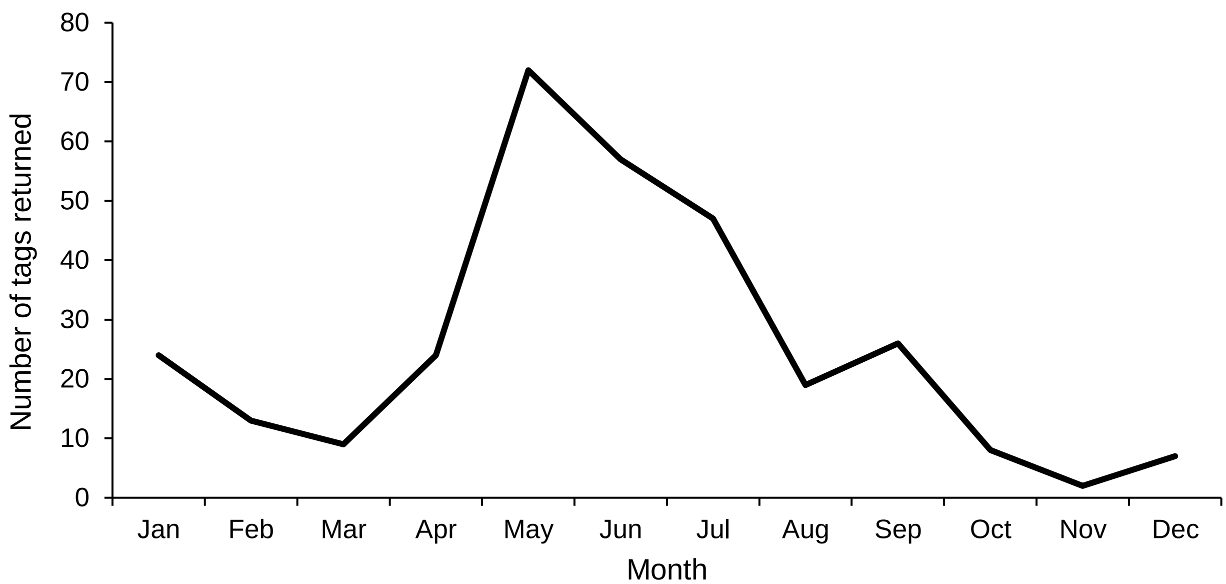

Figure 16. Total count of Yellow Perch tags returns by anglers by month from Lake Cascade for fish tagged in 2009, 2013, 2015, and 2018 combined.

PAYETTE LAKE

ABSTRACT

Payette Lake fishery management is a complicated balancing act between maintenance of kokanee *Oncorhynchus nerka* and Lake Trout *Salvelinus namaycush* abundance. Kokanee stocking was discontinued in Payette Lake in the mid-1990s, when fishery managers determined natural reproduction was likely sufficient for maintaining the population. However, kokanee abundance dramatically declined by the mid-2000s, and Lake Trout abundance increased, while Lake Trout body condition declined substantially. Since 2014, we have been conducting trials to experimentally remove Lake Trout from Payette Lake and decrease their abundance, to thereby improve survival of naturally-reproducing kokanee. In 2018, we began experimental removal of Lake Trout with custom gill nets to attempt to increase our capture efficiency. A total of 713 Lake Trout were captured in the nine weeks of netting, which ranged in size from 400 to 1,100 mm. Mean length and weight was 713 mm and 3,895 g. Mean relative weight was 75, and mean catch rate was 5.8 fish per net night. These values are similar to what was found in 2013 and 2014, indicating no significant change. Additionally, annual counts of kokanee salmon spawning in the North Fork Payette River above Payette Lake showed no increase in abundance following recent Lake Trout removal efforts. We expended $18,555 on Lake Trout removal operations on Payette Lake in 2018.

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INTRODUCTION

The current IDFG Statewide Fisheries Management Plan 2019-2024 (IDFG 2018) lists as an objective for Payette Lake, to “maintain/improve the Payette Lake kokanee (*Oncorhynchus nerka*) fishery by reducing Lake Trout (*Salvelinus namaycush*) predation”.

Kokanee salmon are native to Payette Lake. Evermann (1895) notes the presence of kokanee, Sockeye Salmon, Chinook Salmon *Oncorhynchus tsawythscha*, and Pacific Lamprey *Entosphenus tridentatus* in and around Payette Lake in the late 1800s, as well as abundant native Cutthroat Trout *O. clarkii* and likely Bull Trout *Salvelinus confluentus*. After Cutthroat Trout, kokanee and Sockeye Salmon were likely the most abundant naturally occurring species in the lake. Several gillnet fisheries were operated on Payette Lake in the late 1800s to early 1900s for kokanee and Sockeye Salmon. W.C. Jennings, in 1894, made a statement that two fisheries operating on Payette Lake between 1870 and 1880 harvested over 75,000 “redfish” combined, per year (Evermann 1894). Commercial overfishing and the development of the Snake River and Columbia River hyrdropower systems led to the collapse of the native fisheries in Payette Lake in the early 1900s, and by 1913, fish stocking from outside sources began. By 1920, Cutthroat Trout, Rainbow Trout *Oncorhynchus mykiss*, Brook Trout *Salvelinus fontinalis*, perch (*Perca* spp.) and bass (*Micropterus* spp.) had all been stocked in Payette Lake. By 1930, additional kokanee were being stocked from outside sources; and by 1939, IDFG had implemented an annual stocking program consisting primarily of kokanee and Rainbow Trout. Lake Trout were first stocked in Payette Lake in 1955, and were stocked consistently up until 1985.

Lake Trout have been present in Payette Lake for nearly 65 years, and they (in addition to Rainbow Trout and kokanee) have provided a sport fishery to Payette Lake anglers. The modern Payette Lake fishery was at its peak in the mid-1990s, when anglers frequently caught Lake Trout weighing ~7kg, and Lake Trout weighing up to ~14 kg were not uncommon. Lake Trout in Payette Lake were managed as a catch-and-release trophy fishery at that time, with no harvest allowed. Body condition on Lake Trout in the mid-1990s was excellent, with mean relative weights of 110, due to abundant forage. At that time, annual kokanee pawning escapement in the North Fork Payette River (above Payette Lake) ranged from 45,000 to 65,000 individuals, based on counts conducted by IDFG personnel (1993 – 1997). In 1996, estimated angler effort on Payette Lake was approximately 43,000 hours, most of which was attributed to boat angling.

Kokanee stocking was discontinued in Payette Lake in 1994, when fishery managers determined natural reproduction was likely sufficient for maintaining the kokanee population. Lake Trout and kokanee salmon were seemingly coexisting in a balanced state. Kokanee escapement in the North Fork Payette River (above Payette Lake) declined following the halt of stocking, but still remained relatively high through the early-2000s (mean estimated 27,500 spawners from 1998 to 2001). Until 2001, very little natural recruitment for Lake Trout was suspected in Payette Lake, so biologists conducted bioenergetics modeling to determine whether the abundant, naturally-reproducing kokanee population could support additional stocking of Lake Trout to boost Lake Trout catch rates for anglers. Based on the results of these models, 32,000 catchable-sized Lake Trout were stocked in the lake during 2002 and 2003.

By 2006, kokanee spawner escapement in the North Fork Payette River declined to less than 10,000 individuals per year. Despite reinstating kokanee stocking in 2007 (300,000 to 400,000 fingerlings per year from 2008 to 2014), the kokanee population never recovered. Kokanee spawner abundance continued to decline, and from 2010 to 2017, mean kokanee spawning abundance in the North Fork Payette River declined to 774 individuals, with a maximum count of 1,475 individuals in 2012. Stocking was again halted in 2014 due to lack of survival of stocked kokanee.

During the same time period that the kokanee population experienced dramatic declines, Lake Trout abundance increased. From 1994 to 2014, Lake Trout CPUE during standard gill-netting surveys increased from 0.65 fish/h to 2.8 fish/h; a four-fold increase. As a result of increasing Lake Trout abundance and decreasing forage (kokanee) abundance, Lake Trout body condition decreased substantially to a mean relative weight of 79 by 2014 (Janssen et al. 2016a). In 2013, we began targeting Lake Trout for removal, based on data which indicated the population was increasing; perhaps as a result of successful spawning of the stocked 2002 and 2003 cohorts, and high survival rates exhibited by their progeny. In 2016, Lake Trout bag limits were increased to six fish per day of any size to encourage increased harvest from anglers.

Payette Lake fishery management is complicated, and is a balancing act of ensuring a proper ratio of predator (Lake Trout) to prey (kokanee). The management goal is to maintain both kokanee and Lake Trout fisheries, but the methods to achieving this goal are confounding, as kokanee are the primary forage fish for Lake Trout in Payette Lake. Lake Trout anglers are typically reluctant to harvest Lake Trout as it difficult to understand that removing Lake Trout is a good thing for the fishery. Fishing effort appears to have declined recently and is likely due to low catch rates of quality-size Lake Trout and poor body condition. Additionally, Payette Lake is a very popular water skiing and wake boating lake, which discourages some anglers from fishing there.

In 2014, we conducted a Lake Trout removal pilot study during which we removed 376 Lake Trout (Janssen et al. 2016). In 2016 and 2017, we gillnetted Lake Trout to monitor shifts in relative weight and length-weight relationship from previous sample years (Janssen et al. 2017; Janssen et al. *in press*). In 2018, we began experimental removal of Lake Trout and purchased nine 300-ft custom gillnets from Hickey Brothers Research (HBR) to aid in increased capture efficiency of Lake Trout. These nets are constructed the same as gill nets used for commercial removal operations in Yellowstone Lake and Upper Priest Lake.

We continue to monitor relative abundance of kokanee in Payette Lake via spawner counts in the North Fork Payette River (above Payette Lake) in September.

OBJECTIVES

1. Determine effectiveness (logistics and cost) of using custom-made HBR gill nets to remove Lake Trout from Payette Lake.

2. Monitor Lake Trout size structure and body condition in Payette Lake as an index of relative population health.

3. Monitor kokanee spawner abundance in the North Fork Payette River (above Payette Lake) as an index of relative survival related to Lake Trout predation.

METHODS

Nets were built by Hickey Brothers Research (Sturgeon Bay, WI). Nets were sinking-style, 91.5-m long, and each net was single mesh size, constructed of clear monofilament. Stretched mesh size for gillnets were 50.8, 63.5, 76.2, 88.9, 101.6 and 114.3 mm. Netting sites were randomly chosen and included all three lake basins (southwest, southeast, and the narrows). Nets were set either from and perpendicular to shore or on flats and ridges, in water no less than 12 m in depth to avoid catching large numbers of Northern Pikeminnow *Ptychocheilus oregonensis* and Largescale Suckers *Catostomus macrocheilus*. Nets were set mid-day, fished all night and pulled the following morning. The netting period in 2018 was from June 27 to September 20.

All Lake Trout collected were enumerated, measured for total length (mm) and weight (g), and the size of mesh was recorded. Non-target fish were not measured or enumerated. Relative weights of Lake Trout were calculated only for fish greater than 400 mm. Mean relative weight and 95% confidence intervals (±CI's) were calculated to compare between years. All Lake Trout less than 813 mm were euthanized. Because large Lake Trout are important to anglers, we released all live fish greater than 813 mm. All released fish were marked with either a pink or yellow spaghetti tag. Yellow represented a southwest basin capture area and pink the narrows and southwest basin capture area. All costs associated with the project were compiled to determine cost efficiency for determining whether the netting program should be continued into future years.

Twice weekly during the kokanee spawning run in the North Fork Payette River (above Payette Lake), the stretch of river from the mouth of Fisher Creek downstream approximately 3,400 m and adjacent to the 5010 benchmark (on the Granite Lake 24k topographic map) was walked and all live spawners counted. In 2018, the highest upstream kokanee were observed spawning in a side channel approximately 1,135 m downstream of Fisher Creek (WGS84: 45.030496° N, -116.057997° W). Kokanee were observed from this point downstream approximately 2,200 m where the stream first meets the base of the highway (WGS84:45.020357° N, -116.062609° W) and includes a spring and channel due east of this coordinate approximately 100 m. The total run estimate was made by multiplying the largest daily count by 1.73 (Frost and Bennett 1994). Samples of dead post-spawn kokanee that still have an intact tail were measured for total length.

RESULTS

A total of 713 Lake Trout were captured in the nine weeks of netting. Twenty four separate netting events were conducted where multiple gill nets were set over night. In total, we fished 124 net nights, or 2,888 hours, and caught 708 Lake Trout. The majority of netting effort was made in the west basin to attempt to reduce catch per net night in this basin. The 2018 mean catch rate across all sizes of mesh was 5.8 fish per net night (Table 7). Netting mortalities and fish euthanized totaled 649. We captured 122 fish greater than 812 mm, 59 of which were released alive. We marked 53 Lake Trout with spaghetti tags which were released alive (40 yellow and 13 pink).

We expended $18,555 on Lake Trout removal operations on Payette Lake in 2018. If the cost of gill nets is deducted as a one-time fee for initial purchase, the cost was $15,455 or $21.76 per Lake Trout (Table 8).

Lake Trout sizes ranged from 400 to 1,100 mm (Figure 17), and mean length and weight was 713 mm and 3,895 g. Mean relative weights in 2018 continued to decline to 75 (± 1.2; Figure 18). Mean relative weights in 2006, 2010, and 2014 were 96 (±1.2), 80 (±4.9), and 78 (±6.4), respectively.

We completed four kokanee spawner counts on the North Fork Payette River in 2018. The first count was made on August 29 and the last on September 19. The peak count (583) was made on September 15. The total spawning run estimate was 1,009 (583*1.73) fish (Table 9). Spawning kokanee ranged in length from 354 to 498 mm with a mean of 427 mm (Table 9).

DISCUSSION

Our efforts in 2018 were directed toward determining if we could effectively reduce Lake Trout abundance through directed gill-netting, and if it were a practical, cost-effective solution to improving conditions for increased kokanee survival.

Length-frequency data showed that relative abundance of Lake Trout measuring 400 to 600 mm is still high, and gill net catch rates have not changed with the fish removal efforts made in 2014 and 2017. Gill net catch rates for a single 45.7-m, 150' IDFG experimental net in 2014 was 2.8 fish per night, and in 2017, the catch rate for two IDFG experimental nets tied together was 5.7 fish per night. These catch rates did not differ significantly from the custom Lake Trout, single mesh gill nets used in 2018, which had a catch rate of 5.8 fish per net night. However, mesh sizes and percent of use of different mesh sizes did differ between IDFG experimental and the single mesh gillnets, so CPUE data is not directly comparable. Regardless, it appears removal efforts since 2014 have not effectively decreased Lake Trout abundance, and the mean relative weight of fish over 400 mm has continued in a downward trend.

With the equipment available and time constraints with other activities in the region, it seems unlikely that we could reduce the Lake Trout population enough to allow an increase in kokanee survival, to create a more robust fishery in Payette Lake. However, this is solely based on relative abundance (CPUE) data from random gill net sets over the years. In order to quantitatively determine the current status of the Lake Trout population in Payette Lake, population rate functions need to be calculated. Ng et al. (2016) conducted an assessment of Lake Trout population dynamics in Priest Lake, ID in 2013 in order to model and evaluate a variety of management strategies for control of that population. By quantifying population abundance, age and growth, annual mortality, age at maturation, spawning frequency, and fecundity, researchers were able to determine that the Lake Trout population in Priest Lake was growing at a slow rate ($\lambda = 1.03$), and that a juvenile removal scenario targeting age-2 to age-5 Lake Trout would be sufficient for decreasing overall population abundance. By determining population growth rate (λ), and modeling various scenarios that would decrease population growth rate to less than 1.0, we may find a scenario that is appropriate to decrease overall Lake Trout abundance in Payette Lake with fairly minimal effort, as was done in Priest Lake. Efforts in 2019 should focus on this objective.

Annual spawning escapement of kokanee in the North Fork Payette River has been very low since the early-2000s, despite efforts to boost production in the late-2000s/early-2010s by stocking fingerlings. The issue is confounding; Lake Trout body condition is poor because of low abundance of kokanee, and kokanee abundance is low, likely due to Lake Trout predation. However, it is unknown whether Lake Trout predation is the major cause of poor kokanee survival. In order to determine what is limiting kokanee production, more rigorous studies should be conducted to evaluate kokanee survival, and identify all potential sources of mortality. For example, Northern Pikeminnow are abundant in the lower stretch of the North Fork Payette River (below the kokanee spawning area) and in the littoral areas of Payette Lake. If Northern Pikeminnow predation rates on juvenile kokanee exiting the North Fork Payette River are extremely high, this may contribute to poor survival. Re-establishing kokanee fingerling stocking, and evaluating differences in survival between kokanee stocked in the North Fork Payette River (above the lake) and kokanee stocked directly into the lake could help identify whether there is a predation bottleneck occurring during juvenile outmigration. Paragamian and Bowles (1995) found that release location did not significantly affect hatchery kokanee fingerling survival in Lake Pend Oreille, ID, but release timing did. They found that hatchery kokanee fingerlings stocked later (July vs June), at larger size, into water with higher zooplankton quality and quantity, had higher survival than smaller kokanee stocked earlier in the year. Further study in Payette Lake should evaluate various scenarios of size, time, and location at release for stocked kokanee fingerlings, to determine whether there is a scenario that could improve overall kokanee survival to meet our management objectives for the fishery.

MANAGEMENT RECOMMENDATIONS

1. Quantify Lake Trout population rate functions and ultimately population growth rate (λ) in 2019, to determine how much effort may be necessary to effectively reduce long-term abundance in Payette Lake.

2. Re-establish kokanee fingerling stocking, and evaluate differences in survival between various stocking strategies to determine most appropriate strategy for meeting management objectives.

Table 11. Lake Trout gill net catch by stretch mesh size collected from Payette Lake from summer through fall 2018.

Net size	Nights	Hours	Fish caught	CPUE/night	CPUE/hour
2.0	18	416.5	102	5.67	0.24
2.5	24	555.0	115	4.79	0.21
3.0	8	188.5	51	6.38	0.27
3.5	29	666.0	177	6.10	0.27
4.0	19	456.5	93	4.89	0.20
4.5	26	605.0	175	6.73	0.29
Totals	124	2887.5	713	5.76	0.25

Table 12. Expense summary for Lake Trout gill net removal in Payette Lake, Idaho, June – September, 2018.

Line item	Cost
Personnel cost; including benefits	$14,100
Boat fleet cost	$735
Vehicle fleet cost	$620
Gill net purchase	$3,100
Total expenses	$18,555

Table 13. Payette Lake kokanee spawner counts and estimated spawning run size and biomass from 1988 through 2017 in the North Fork Payette River.

Year	Peak count	Estimated spawner numbers	Kg/lake ha[1]	Number/lake ha[1]	Average spawner weight (g)	Average spawner TL (mm)
1988	13,200	22,800	4.6	13.3	346	--
1989	8,400	14,500	2.9	8.4	349	--
1990	9,642	16,700	3.5	9.7	358	--
1991	10,400	18,000	5.3	10.5	505	365
1992	16,945	29,300	6.4	17.1	377	
1993[a]	34,994	59,310	8.5	34.6	245	--
1994	25,550	44,200	5.5	25.8	214	--
1995	32,050	55,450	4.8	32.3	147	260
1996	35,090	60,707	5.7	35.4	162[c]	--
1997	36,300[e]	64,891[d]	5.6	37.8	148	265
1998	14,585	25,232	2.1	14.7	143	254
1999	15,590	26,971	2.9	15.7	184	276
2000	15,520	26,850	2.9	15.6	188	286
2001[f]	15,690[g]	30,144	4.4	17.6	250b	--
2002	9,430	16,314	--	9.5	--	--
2003	5,430	9,394	1.5	5.5	279	--
2004	11,290	19,532	--	11.4	--	--
2005	11,780	20,780	--	12.1	--	--
2006	5,580	9,650	--	5.6	--	317
2007	3,925	6,790	1.6	4.0	401	340
2008	2,425	4,195	--	2.4	--	336
2009	1,290	2,232	--	1.3	--	405
2010	610	1,055	--	0.6	--	416
2011	435	753	--	0.4	--	390
2012	852	1,475	--	0.8	--	376/440[h]
2013	304	526	--	0.3	--	384/458[h]
2014	245	424	--	0.25	--	-
2015	185	320	--	0.2	--	455
2016	364	630	--	0.4	--	404
2017	583	1,008	--	0.6	--	383/451[h]
2018	420	727	--	0.4	--	442/519[h]

[1] 1,717 ha usable kokanee habitat in Payette Lake (Area with depth greater than 40 feet).
[a] Estimate made from stream and weir counts (Frost and Bennett, 1994)
[b] From gill net data of captured spawners in Payette Lake during lake survey.
[c] From trawling collections made in September 1996.
[d] Includes 2,092 fish spawned and removed by Nampa Fish Hatchery.
[e] Does not include 2,092 fish spawned and removed by Nampa Fish Hatchery.
[f] Includes 3,000 fish spawned and removed by Nampa Fish Hatchery.
[g] Does not include 3,000 fish spawned and removed by Nampa Fish Hatchery.
[h] Two distinct age classes.

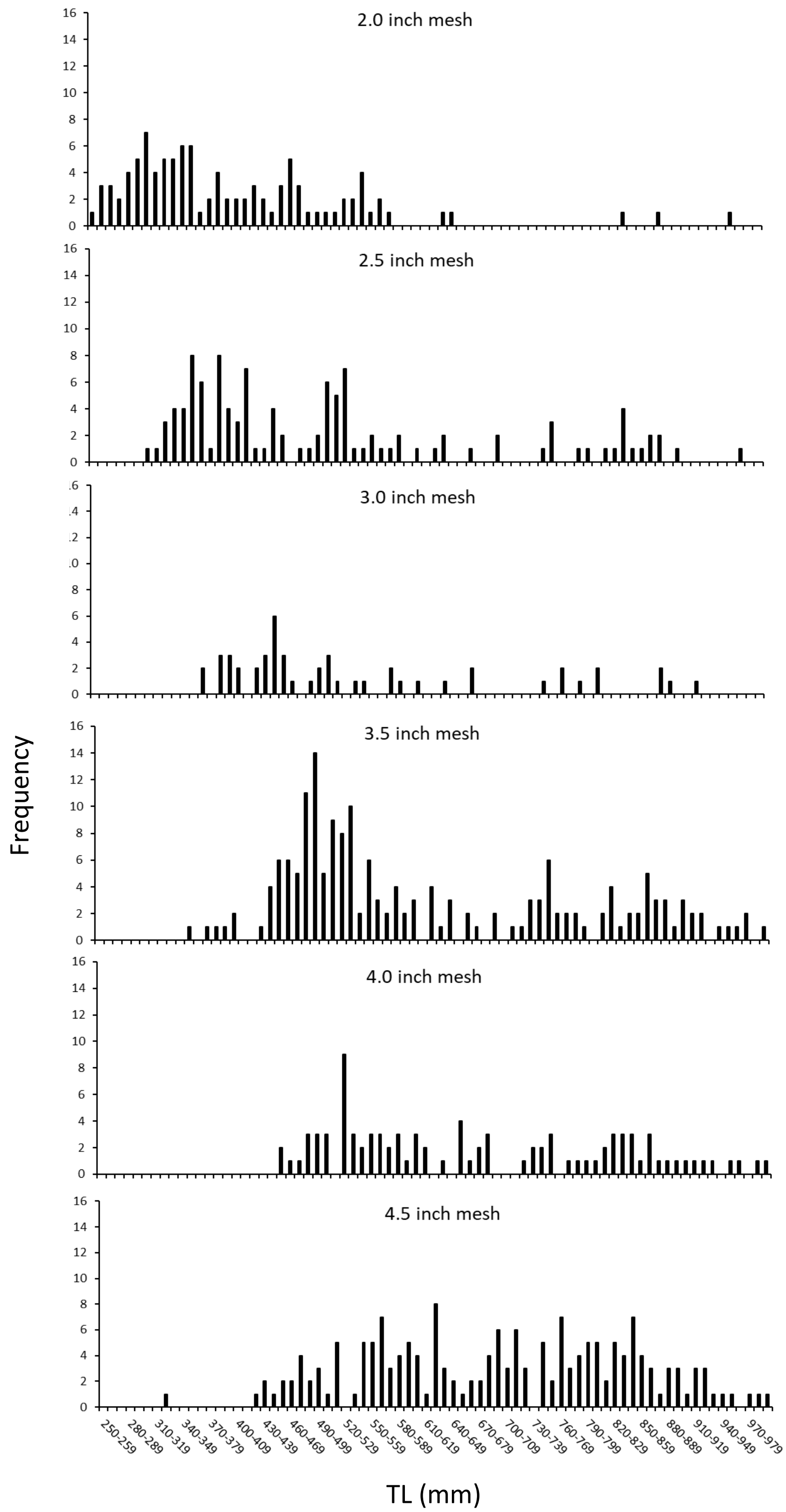

Figure 17. Length-frequency histogram for Lake Trout sampled by gill net collected in Payette Lake in summer/fall 2018.

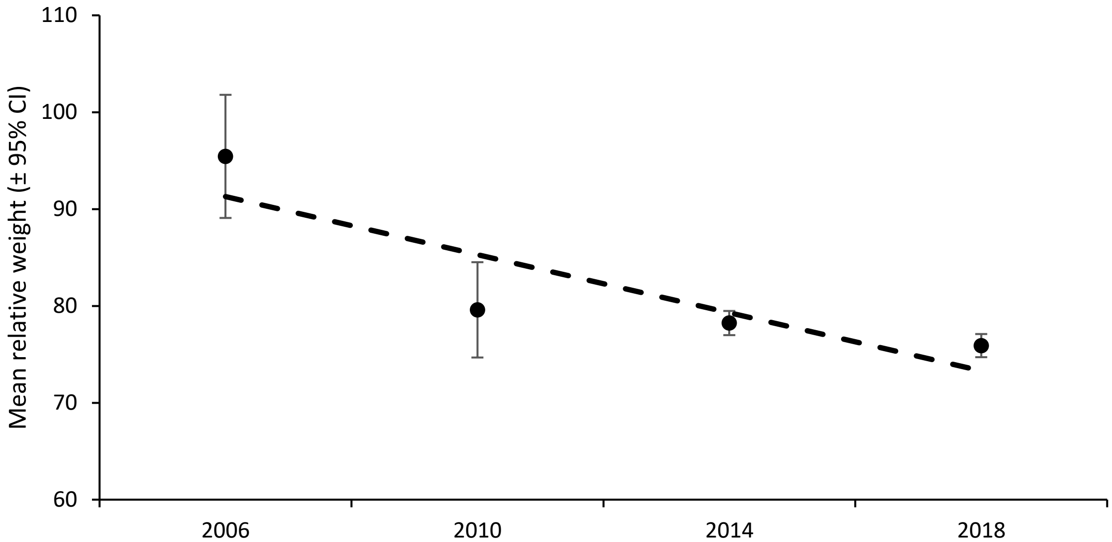

Figure 18. Mean relative weights (± 95% CI) for Lake Trout collected with gill nets in Payette Lake in summer 2006, 2010, 2014, and 2018.

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APPENDICES

Appendix A. Intercept (*a*) and slope (*b*) parameters for standard weight (W_s) equations, taken from Blackwell et al. (2000). $Log_{10}(W_s) = a' + b * Log_{10}(\text{total length (mm)})$.

Species	Intercept (*a*)	Slope (*b*)	Minimum TL (mm)	Source
Cutthroat Trout (lotic)	-5.192	3.086	130	Kruse and Hubert, 1997
Cutthroat Trout (lentic)	-5.189	3.099	130	Kruse and Hubert, 1997
Lake Trout	-5.681	3.246	280	Piccolo et al., 1993
Tiger muskellunge	-6.126	3.337	240	Rogers and Koupal, 1997
Rainbow Trout (lentic)	-4.898	2.99	120	Simpkins and Hubert, 1996
Rainbow Trout (lotic)	-5.023	3.024	120	Simpkins and Hubert, 1996

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